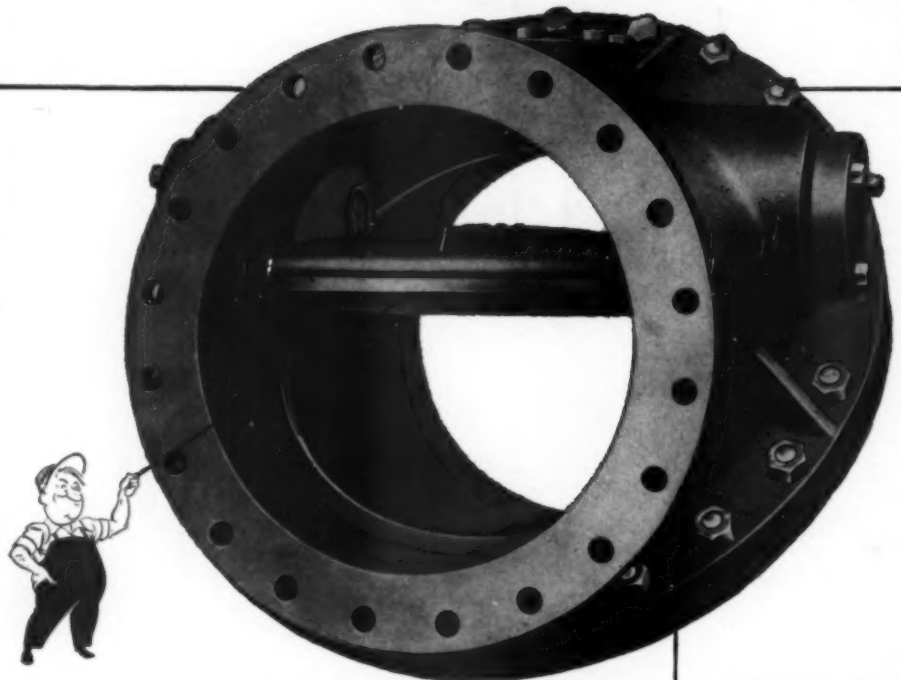
# WATER & SEWAGE WORKS

WATER SUPPLY • INDUSTRIAL WASTE TREATMENT • SEWAGE DISPOSAL

JUNE, 1951

Little Rock's 33 Mile Raw-water Supply Line

# Stop Expensive Slamming With the Cushioned Closing of CHAPMAN TILTING DISC Check Valves

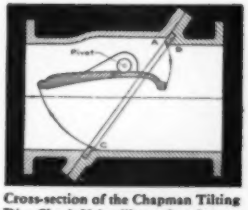


Those words — *cushioned closing* — best describe the action of this unique check valve. The tilting disc works with the stream—opens easily, closes quickly, *yet quietly.* There's no slamming — no resultant destructive stresses on the pipeline.

As a result of this smooth, *cushioned action*, maintenance costs are at a minimum and savings of from 65% to 80% in head losses can be obtained over conventional-type check valves.

Send today for the bulletin describing this unusual valve.

**THE CHAPMAN VALVE MFG. CO.**
**INDIAN ORCHARD, MASSACHUSETTS**




Cross-section of the Chapman Tilting Disc Check Valve illustrating the way that the balanced disc is supported on the pivot, with arrows showing the travel of the disc. A feature of the design is that the disc seat lifts away from the body seat when opening, and drops into contact when closing, with no sliding or wearing of the seats.

# THE ECONOMICS OF METER REPAIRS

## SOME TIPS ON GOOD MAINTENANCE PRACTICE

Properly maintained water meters will return the cost of servicing many times over by providing a longer useful life of accurate registration.

Many progressive water works men have a fixed time for removing meters

These simple tools speed repair work

from service. Frequently a replacement meter is immediately installed to avoid interruption in metering. It is suggested that a repaired meter test at least 90 per cent on a ¼ gpm. flow.

### Testing Equipment Recommended

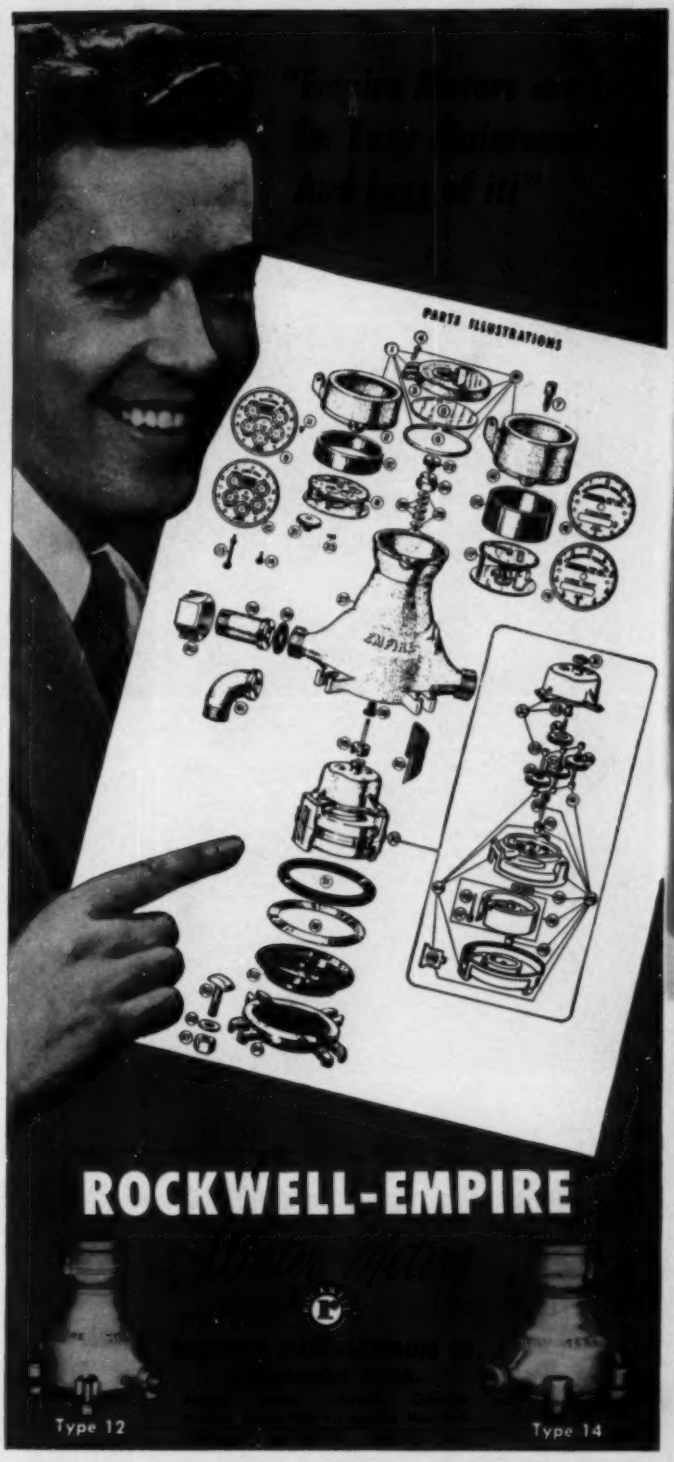
All meter departments should be equipped with proper test stands, preferably of the volumetric type, periodically checked for correct calibration in which both new and repaired meters can be proved for accuracy. The wisest policy is to test all meters before installation. Some facilities should be provided for tests at minimum flow rates. These rates should be carefully checked by means of a stop watch or a rate-of-flow indicating device. The old method of testing on a ¼" or ⅛" stream is not recommended today since the orifices will wear and the flow will vary with pressure change.

It has been found through experience that simply taking a meter apart and cleaning the complete assembly is very often all the maintenance required. In old, very worn meters it is wise to assemble complete units such as new gear trains and new discs with new half balls. Oscillating piston meters can usually be restored to new meter performance by simply installing a new piston in the old chamber.

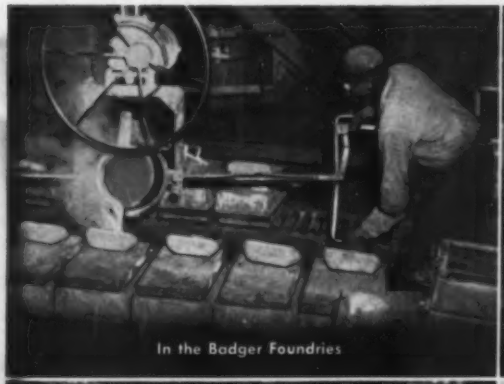
### Storing Meters

When storing meters, either new or repaired, it is advisable to put them in a cool place and preferably to set them upside down. Hard rubber is a sensitive material and prolonged exposure to heat in a closed, unventilated building or to excessive artificial heat can have damaging results. Thus accuracy and pressure tests on meters that have been stored for long periods of time are extremely important.

Proper tools will facilitate meter repair work. Rockwell Manufacturing Co. has developed a simple repair tool set (see cut) that is available at nominal cost. For information write Rockwell at 400 N. Lexington Ave., Pittsburgh 8, Pa.



# Badger-Controlled Precision and Quality mean more for your meter-money


In the Badger Foundries

In Badger Precision Machine Shops

On Badger Precision Assembly Lines

In Badger Precision Testing

## From start to finish of every type and size of Badger Meter
## precision and quality are Badger-Controlled

"MEASURING THE WATER OF THE WORLD"

*First for Accuracy • Low-Cost Maintenance • Durability • Sensitivity*

**BADGER *Water* METERS**

**BADGER METER MFG. CO., Milwaukee 10, Wis.**

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WATER AND SEWAGE WORKS. Reg. U. S. Patent Off. Published monthly by Gillette Publishing Co., at 404 North Wesley Ave., Mount Morris, Ill. Entered as second class matter Mar. 4, 1948, at the post office at Mount Morris, Ill., under Act of Mar. 3, 1879. For subscription rates, see Contents Page.

# WATER & SEWAGE WORKS

WATER SUPPLY • SEWAGE DISPOSAL
INDUSTRIAL WASTE TREATMENT


## COMING ARTICLES

"A Decade of Calgon Treatment" and what it has accomplished in corrosion control on several supplies of the New Haven Water Co. is related by Marshall Wellington, Sanitary Engr. of the Company . . . . "The Biosorption Process" is a new development in sewage treatment possessing promise. It is described by its inventors A. H. Ullrich, Supt. of Treatment Plants and M. W. Smith, Chemist, at Austin, Texas. . . . "Collections and Complaints" is one of a series of articles by A. E. Clark dealing with small plant operation. . . . "Solving the Distillery Waste Problem" of Hiram Walker and Sons of Canada is an exceptionally interesting story by C. T. Carson, Engr. and Vice-pres.


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*Water & Sewage Works* is indexed regularly by Engineering Index, Inc.

Published Monthly—subscriptions in the U.S., Canada and Latin America $2.00 per year; Foreign $3.00. Single copies 25c *except this issue 50c.*

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# STRENGTH is vital

**Be doubly sure when you specify pipe for mains to be laid under city pavements. Sure that it effectively resists corrosion. Sure, also, that it has the four strength factors, listed opposite, that pipe must have to withstand beam stresses, external loads, traffic shocks and severe working pressures. *No pipe, deficient in any of these strength factors, should ever be laid in paved streets of cities, towns or villages.*** **Cast iron water and gas mains, laid over a century ago, are serving in the streets of more than 30 cities in North America. These attested service records prove that cast iron pipe not only assures you of effective resistance to corrosion but all of the vital strength factors of long life and economy.**

# in pipe for city streets

*No pipe that is deficient in any of the following strength factors should ever be laid under paved streets.*

## CRUSHING STRENGTH

The ability of cast iron pipe to withstand external loads imposed by heavy fill and unusual traffic loads is proved by the Ring Compression Test. Standard 6-inch cast iron pipe withstands a crushing weight of more than 14,000 lbs. per foot.

## BEAM STRENGTH

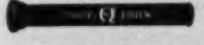
When cast iron pipe is subjected to beam stress caused by soil settlement, or disturbance of soil by other utilities, or resting on an obstruction, tests prove that standard 6-inch cast iron pipe in 10-foot span sustains a load of 15,000 lbs.

## SHOCK STRENGTH

The toughness of cast iron pipe which enables it to withstand impact and traffic shocks, as well as the hazards in handling, is demonstrated by the Impact Test. While under hydrostatic pressure and the heavy blows from a 50 pound hammer, standard 6-inch cast iron pipe does not crack until the hammer is dropped 6 times *on the same spot* from progressively increased heights of 6 inches.

## BURSTING STRENGTH

In full length bursting tests standard 6-inch cast iron pipe withstands more than 2500 lbs. per square inch internal hydrostatic pressure, which proves ample ability to resist water-hammer or unusual working pressures.

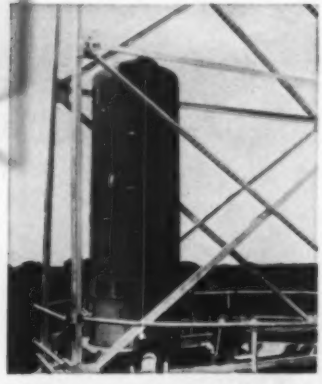


CAST IRON PIPE RESEARCH ASSOCIATION, THOS. F. WOLFE, MANAGING DIRECTOR, 122 SO. MICHIGAN AVE., CHICAGO 3.

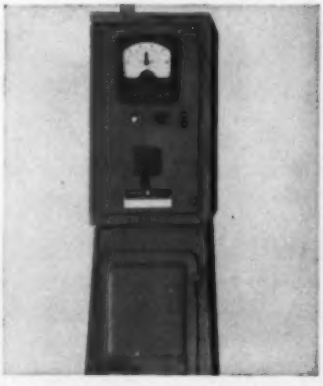
**CAST IRON PIPE SERVES FOR CENTURIES**

# WACO ADOPTS NEW

**Requirements of Waco's water system** are 15 mgd or 10,000 gpm. The new G-E MACA pump drive which enables operator to maintain this constant flow is mounted on surge tank at far right. Other buildings are filter plant at left, and pump house, right. Water is carried underground from Lake Waco and the Brazos River.



**Infinite-step speed range** of G-E MACA drive motor is 675–540 rpm with corresponding output range of 200–160 hp. The 2300-volt motor is designed for heavy-duty service.



**Speed is controlled** from this station. Operator notes flow on indicating meter and adjusts motor speed. Operator's function can be handled automatically with added equipment.

**Accelerating contactors** and starting resistor for the MACA drive are housed in a secondary control cubicle. The contactors' function is to accelerate MACA motor to operating speed.

GE CO-ORDINATED WATER-PLANT ELECTRIFICATION

# G-E DRIVE NOW...

# FOR MORE WATER TOMORROW

## Wide head variations overcome, constant flow maintained with new G-E adjustable-speed pump drive

Uniform efficiency over a wide speed range plus adjustable-speed in an infinite number of steps explain why the Board of Water Commissioners of Waco, Texas, and their consulting engineer chose the new General Electric MACA drive to help solve the city's water supply problems.

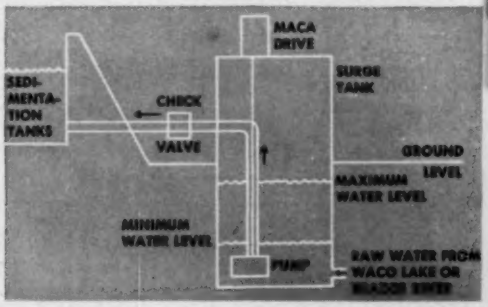
Water to be treated is taken from Lake Waco and the Brazos River. Unusual conditions cause considerable fluctuation of the water level in the plant's surge tank. Maintaining the necessary constant flow of 10,000 gpm under these conditions calls for an efficient pump drive whose speed can be readily adjusted to meet the radical head variations.

With the MACA adjustable-speed drive, the problem is met in this way: A meter indicates when a variation in flow occurs. The operator then selects the proper drive speed from the infinite number of speed steps available to bring the flow back to desired value.

Development of the MACA adjustable-speed drive stems from General Electric's experience in furnishing drives, power-distribution systems and process controls for water plants and many other industries. Out of this same background has come G-E co-ordinated water-plant equipment, noted for its reliability.

Find out more about MACA drive from your G-E representative. He can show you how this and other General Electric equipment, together with G-E application engineering means real teamwork in the modernization of your plant's electrical system. See him now. He can be of most help early in the planning stage. *General Electric Company, Schenectady 5, N. Y.*

MACA-drive primary control is located in the cubicle at the right, incorporated in the G-E Limitamp control panel for the treatment plant. When additional motors make more control space necessary, cubicles can be easily and quickly added.

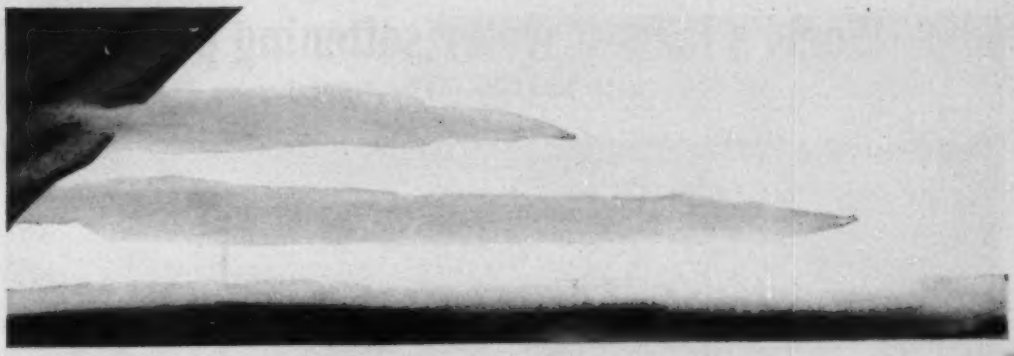



The hydraulic, pumping and drive equipments are shown in this schematic diagram of the surge-tank area of the Waco Treatment Plant. Regardless of wide head variations in the raw-water sources, the MACA drive enables the operator to maintain constant flow of 10,000 gpm into the treating tanks.

GENERAL ELECTRIC

JOHNS-MANVILLE PRODUCTS

**Johns-Manville**



# tax savings for the future

**Three billion, two hundred and fifty million dollars*—that's what it will take to foot the bill for new water system construction so urgently needed by the American people during the next ten years!**

For the thousands of communities that must carry a share of this additional investment, the vital need for water system expansion is most unwelcome at this time in the face of constantly rising costs.

This means that, wherever possible, water works officials will be called upon to keep an exceptionally close watch on expenditures . . . to see that the money laid out for new systems brings the greatest possible return to the taxpayer.

Since a sizable part of the cost of any water system involves the supply and distribution lines, an important question to be answered by these officials will be: "Which pipe will give the greatest return from this portion of our investment?"

*Thousands of communities have already found the answer to this question in Transite Pressure Pipe.*

A threefold warranty of economy is built into every length of Transite Pressure Pipe . . . the modern pipe developed by Johns-Manville through research and engineering to carry water more efficiently:

1. ***Long service life*** . . . because Transite Pipe is made of three inherently corrosion-resistant materials—asbestos, cement and silica—and is steam cured under pressure by a special Johns-Manville process which assures *maintained strength in service.* Carefully kept records of performance in highly corrosive soils prove that conditions which seriously weaken other pipe materials have little effect on Transite.

2. ***Low operating costs*** . . . because Transite Pipe has a smooth interior surface which provides a high water-carrying capacity (C=140). Moreover, because Transite cannot tuberculate, this high carrying capacity *remains* high through the years. Pumping costs, as a result, stay low. Delivery of a full volume of water at lowest operating cost is assured.

3. ***Maximum water economies*** . . . because Transite Pipe has tight, yet flexible joints that *stay* tight in service. These joints absorb vibration and soil stresses, cut down on costly underground water leakage. This is especially important today when water supplies in many localities must be conserved to the limit to meet constantly increasing water consumption.

In addition to these assurances of tax savings for the future, Transite Pressure Pipe offers many *immediate* economies, such as important savings in time and money during installation . . . further sound reasons why it will pay you and your community to specify Transite for the greatest return from your pipe investment.

*From THE WALL STREET JOURNAL, May 26, 1950

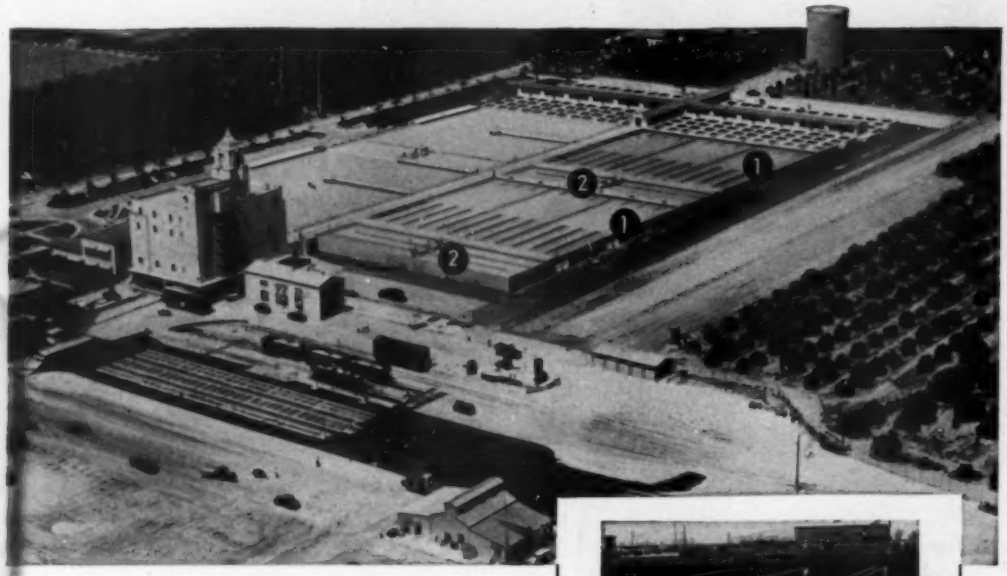
**For complete information write Johns-Manville, Box 290, New York 16, N. Y.**

# TRANSITE PRESSURE PIPE

Transite is a registered Johns-Manville trade mark

# World's largest water softening plant

## doubles capacity with LINK-BELT equipment

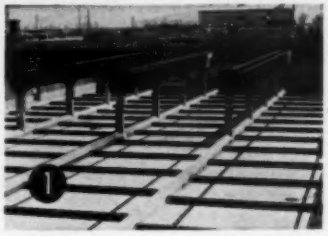



### Selects Straightline Mixers and Collectors to get better quality of water

To meet the demands of its rapidly expanding population, Southern California's Metropolitan Water District recently added another 100 mgd capacity to their water softening plant at LaVerne. And, as in many of the country's most efficient water treatment plants, Link-Belt Sanitary Engineering Equipment was selected for the mixing and sedimentation tanks.

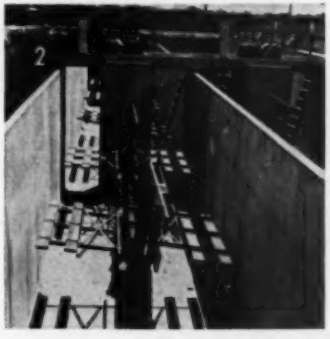
Straightline Mixers and Collectors are only two items in the complete Link-Belt line for water, sewage and industrial liquids treatment. All are designed and manufactured to the highest standards of precision. All are built with Link-Belt components—chains, drives, bearings, conveyors—for positive results and top efficiency.

Our sanitary engineers will be happy to work with your engineers, chemists and consultants. Drawing upon the complete Link-Belt line . . . and over 30 years' experience in this field—they'll help you get the best in modern treatment equipment.




Two 200 x 200 ft. settling tanks at LaVerne have Straightline Collectors *(above)*. Peak-cap bearings, pivoted flights and "Straightline Action" mean top efficiency.

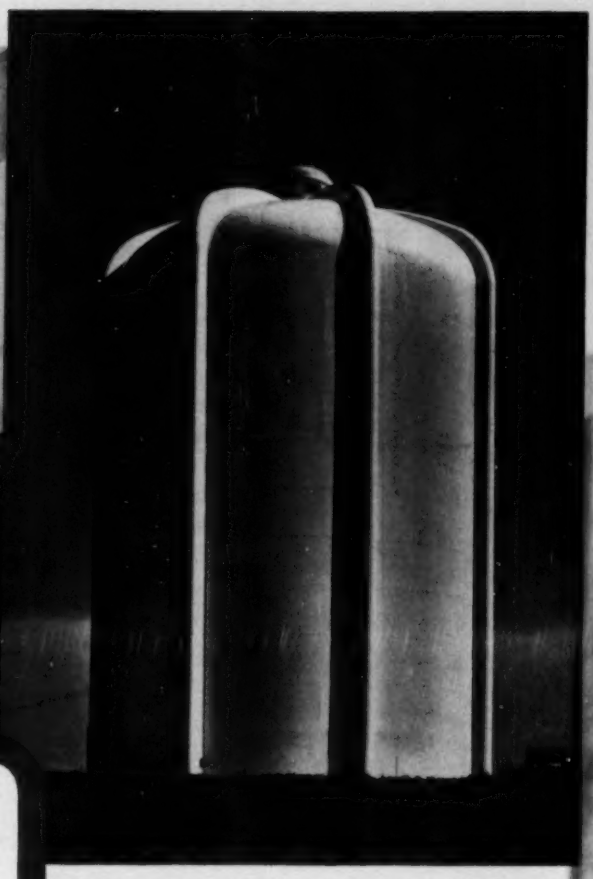
Straightline Paddle Mixers *(below)* provide gentle rolling action in two 48 x 200 ft. mixing tanks. Drive units for all tanks are Link-Belt Electrofluid Drives with "Cushion Action".




LINK-BELT

SANITARY ENGINEERING EQUIPMENT

LINK-BELT COMPANY: Philadelphia 40, Chicago 9, San Francisco 24, Indianapolis 6, Atlanta, Houston 1, Minneapolis 5, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa). Offices in principal cities. 13,111



# MADISON
## CAN TELL YOU ABOUT MODERN WATER STORAGE

LONGFELLOW, in his tribute, "Four Lakes of Madison," describes Wisconsin's capital as ". . . the fair city of the West." Nestled between Lake Mendota and Lake Monona, it has inspired many authors to write of its natural beauty. Others speak of the State House or the University of Wisconsin.

The people of Madison can be justly proud of their city, and even more so of the progressive planning that has resulted in a long record of civic improvements.

It is this planning that gives Madison a fine water system. Recently, a modern 3,000,000-gallon welded-steel standpipe was erected by the Chicago Bridge & Iron Company to further complement the existing water storage capacity and provide increased water pressure.

In addition to standpipes and reservoirs, we build Horton elevated tanks in standard capacities ranging from 5,000 to 3,000,000 gallons. Write for information.

**HORTON**

WELDED STEEL STORAGE TANKS

**CHICAGO BRIDGE & IRON COMPANY**

Plants in Birmingham, Chicago, Salt Lake City, and Greenville, Pa.

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| Birmingham 1 | 1886 North Fiftieth Street | New York 6 | 2390-165 Broadway Building |
| Boston 10 | 1048-201 Devonshire Street | Philadelphia 3 | 1644-1700 Walnut Street Building |
| Chicago 4 | 2199 McCormick Building | Salt Lake City 4 | 860 West 17th South Street |
| Cleveland 15 | 2262 Guildhall Building | San Francisco 11 | 1683-200 Bush Street |
| Detroit 26 | 1551 Lafayette Building | Seattle 1 | 1350 Henry Building |
| Havana | 402 Abreu Building | Tulsa 3 | 1646 Hunt Building |
| Houston 2 | 2115 National Standard Building | Washington 6, D.C. | 1109 Cafritz Building |

Information Courtesy Dept. of Public Works, New York City

Photo by Fairchild Aerial Surveys, Inc.

The vital importance of air diffusion processes to New York City's extensive pollution control program was at once evident to its engineers. Five large plants now use activated sludge or modified aeration treatment, three more are under construction, and several others are planned.

This type of aeration gives the high degree of treatment—at low cost—needed to meet New York City's acute conditions. Dense population, limited plant sites, and odor control are all critical factors.

Porous ceramic diffuser plates and tubes *have been used exclusively* for this program. *And* ALOXITE *aluminum oxide diffusers are installed in four of the five aeration plants now operating—and will be installed in all three under construction.*

**These are the 8 sewage treatment plants**

Wards Island
Tallmans Island
Bowery Bay
Jamaica
26th Ward
Hunts Point
Owls Head
Rockaway

May we send you our new booklet, "Porous Media for Filtration and Diffusion"? Its 56 pages are crammed with useful data. No obligation, of course.

**THE CARBORUNDUM COMPANY**

Dept. M-61, Refractories Div. • Perth Amboy, New Jersey

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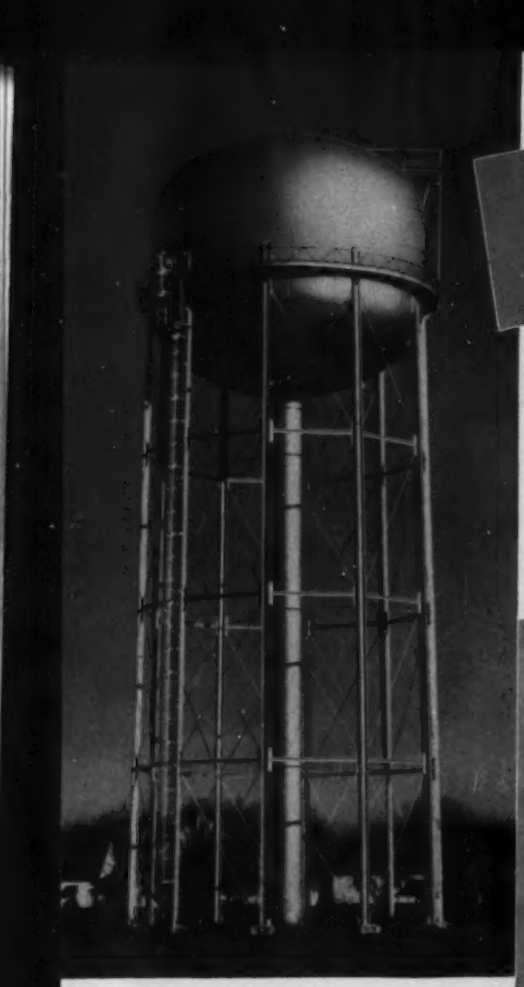
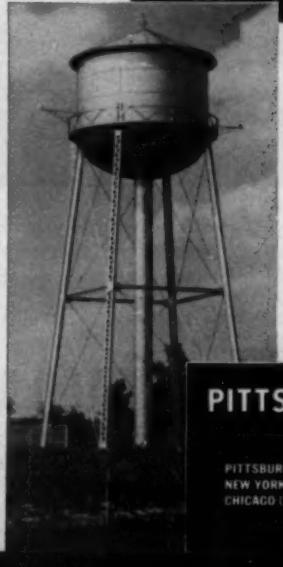


EVERY TYPE AND SIZE—
FOR EVERY NEED!

# *Elevated Steel Tanks*

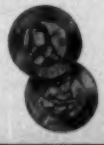
## by PITTSBURGH • DES MOINES

*Write today for our complete Elevated Steel Tank Brochure*



**For all municipal water storage requirements, Pittsburgh-Des Moines Elevated Steel Tanks are supplied in a wide range of designs, and in capacities up to 2,500,000 gallons. ● Uniform pressures around the clock, supply during interruptions in pumping, lower pumping costs are but a few of the many reasons for this low-cost investment.**

***May we discuss the facts with you?***



**PITTSBURGH • DES MOINES STEEL CO.**

Plants at PITTSBURGH, DES MOINES and SANTA CLARA

Sales Offices at:

| | | | |
|---|---|---|---|
| PITTSBURGH (25) | 3418 Neville Island | DES MOINES (8) | 919 Tuttle St. |
| NEW YORK (7) | Room 918, 270 Broadway | DALLAS (1) | 1223 Praetorian Bldg. |
| CHICAGO (3) | 1222 First National Bank Bldg. | SEATTLE | 926 Lane Street |
| SANTA CLARA, CAL. | 625 Alviso Road | | |

# SIMPLICITY of AMERICAN METERS

MEANS EASIEST ASSEMBLY

American Meters always assemble right-side up. Works can always be fully inspected after assembly before putting the top casing in place. No locating pins are needed and any way the meter goes together is a right way.

Quick dismantling and re-assembly is possible when repairs are necessary because American Meter parts are fully interchangeable yet have extreme simplicity of construction. These features give you more earning time for each meter, reduce shop time for servicing.

Write today for full information.

## BUFFALO METER CO.

2909 MAIN STREET, BUFFALO 14, NEW YORK

BUCYRUS ERIE
HYDROCRANE
Here an H-3 sets a 4,800-lb. section of 30-in. pipe. Note that with boom telescope retracted, crane works easily under trees.

# Precision Control Hydrocrane "Cushions" Pipe Into Place

With every crane function fully hydraulic, operator can meter power flow so slowly you can barely see the load move — or he can speed operation to provide a fast, even work pace.

Here's what hydraulic action and pin-point control can mean to you:

**TELESCOPING BOOM** noses under branches, wires, into windows, freight cars — without moving crane an inch. Pipe sections, valves, hydrants can be eased into place quickly, accurately without damaging trees, power lines.

**"DEADMAN CONTROL"** provides automatic protection for pipe crews. If operator should let go, lever returns to neutral — load stops dead. Pipe can be inched into place with greater safety to men.

**EMERGENCY STAND-BY.** Crane's 50 mph. top speed cuts travel time on leak repairs. Fast action hydraulic outriggers extend in seconds — provide a firm, solid base, even on rough ground.

**SIMPLE TO OPERATE.** Hand levers only — no tricky hand-foot coordination, no brakes and clutches to grab or slip. That's why inexperienced men become proficient Hydrocrane operators in amazingly short time.

Two sizes — ¼-yd. 2-ton, ⅜-yd. 3-ton. Attachments include clamshell, crane hook, 1-yd. material handling bucket, catch basin bucket, grapples, magnet.

**BUCYRUS-ERIE HYDROCRANE DIVISION**
**South Milwaukee, Wisconsin**

Gentlemen: ☐ Please send Hydrocrane literature.
☐ I want a Hydrocrane demonstration.

Name_____

Company_____

Address_____

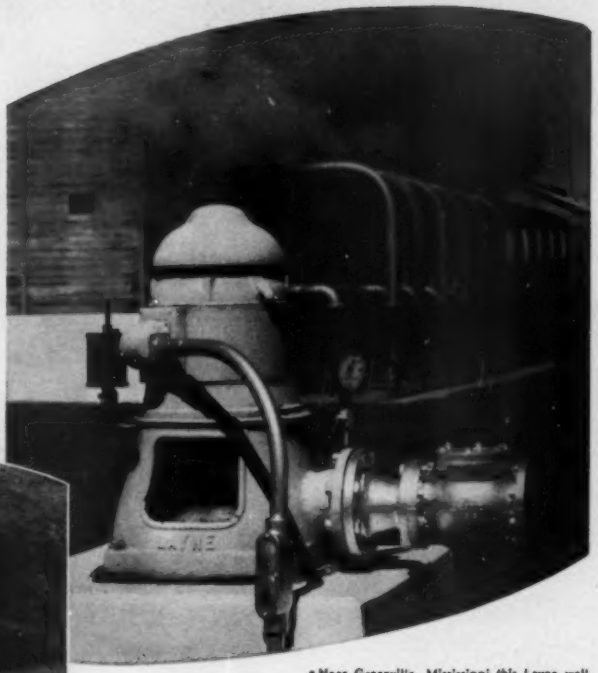
City_____ State_____

BUCYRUS-ERIE HYDROCRANE DIVISION
South Milwaukee, Wisconsin 1099H51

# THEY ARE WORKING ON THE BIG PIPELINES

## WHERE WATER FAILURE WOULD STOP EVERYTHING

A lot of new Layne wells and pumps are serving the big inch pipelines,—and more are being installed. The selection of these fine water supply systems was based on such features as;—basically sound engineering ideas, higher overall quality, top flight efficiency,—and their ability to handle peak production on an around the clock schedule. Installed by Layne's own field crews and according to Layne's rigid standards, they will give years and years of fine service with little or no upkeep expense.



• Near Greenville, Mississippi this Layne well and pump installation furnishes cooling water for a pumping station on a big inch pipeline.

• This Layne well and pump installation in Gregg County, Texas supplies water for general use on a big inch pipeline booster station.

LAYNE is the Nation's greatest organization engaged exclusively in the designing and building of modern high efficiency well water systems. Layne has made more installations than any other organization in the world and is recognized as being the best qualified of all firms now in the business of developing well water. Such qualifications enable Layne to do every job complete and right, whether for a single unit, a dozen—or hundreds. For further information, new catalogs, bulletins, etc., address

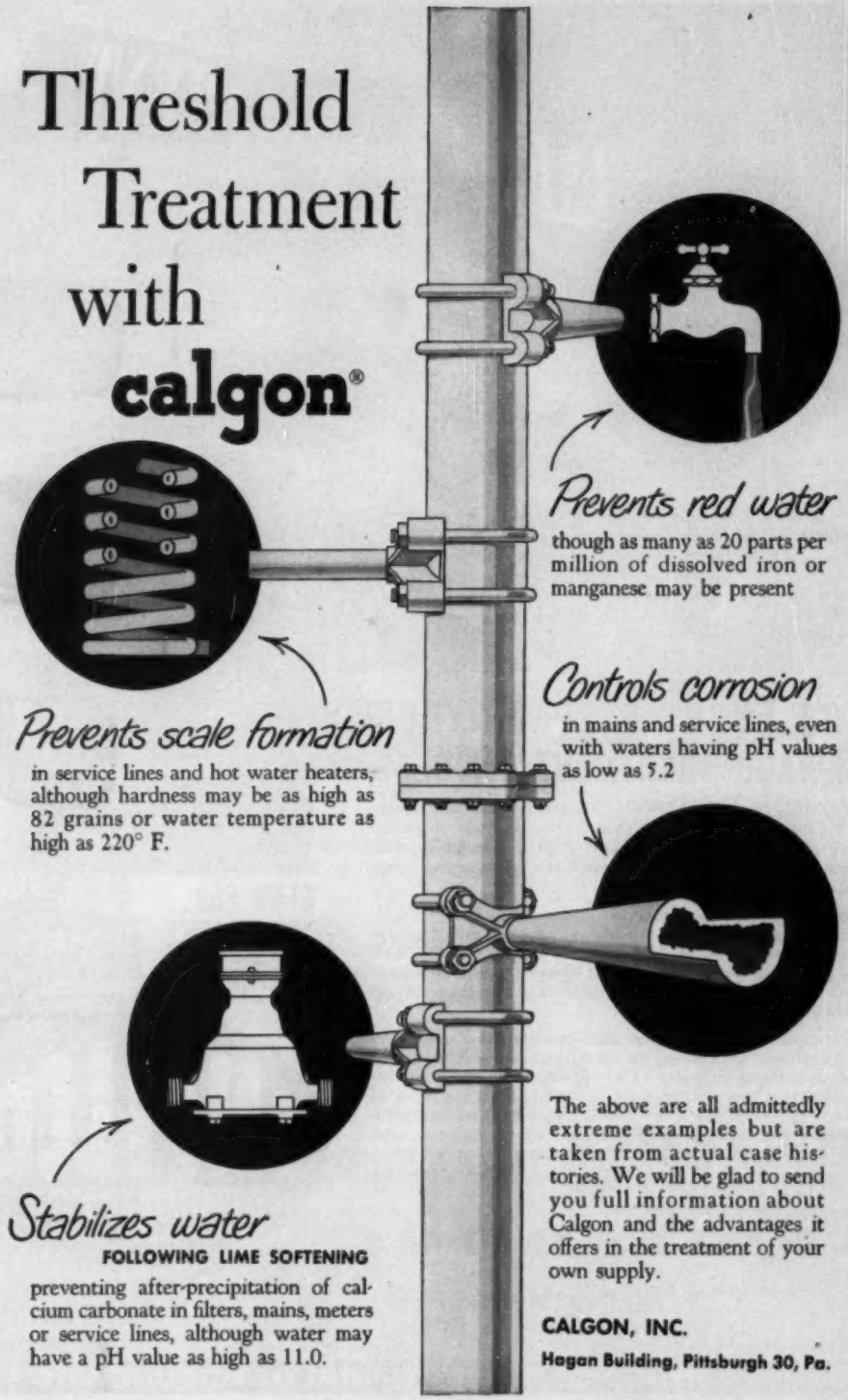
**LAYNE & BOWLER, INC., GENERAL OFFICES, MEMPHIS 8, TENN.**

### NEW LITERATURE

Catalogs and bulletins: Layne Well Water Systems,—Layne Short Coupled Service Pumps,—Layne Oil Lubricated Vertical Turbine Pumps,—Layne Water Lubricated Vertical Turbine Pumps,—Layne Cemented Wells,—Layne Stainless Steel and Monel Metal Shutter Screens,—Layne Ingot Iron Shutter Screens,—Layne Silicon Bronze Shutter Screens,—Layne Irrigation Pumps,—Layne Chemical Treatment for Water Wells,—Layne Water Flow and Pipe Orifice Measurement Hand Book. Sent gratis and without obligation. Please use your Company's letterhead.

Layne
WATER SUPPLY
WELLS & PUMPS

# Threshold Treatment with calgon®



## Prevents red water

though as many as 20 parts per million of dissolved iron or manganese may be present

## Prevents scale formation

in service lines and hot water heaters, although hardness may be as high as 82 grains or water temperature as high as 220° F.

## Controls corrosion

in mains and service lines, even with waters having pH values as low as 5.2

## Stabilizes water

**FOLLOWING LIME SOFTENING**

preventing after-precipitation of calcium carbonate in filters, mains, meters or service lines, although water may have a pH value as high as 11.0.

The above are all admittedly extreme examples but are taken from actual case histories. We will be glad to send you full information about Calgon and the advantages it offers in the treatment of your own supply.

**CALGON, INC.**

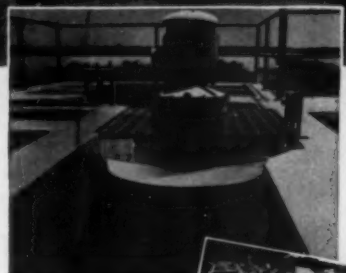
**Hagan Building, Pittsburgh 30, Pa.**

## FOR EVERY STEP OF YOUR SEWAGE TREATMENT PROCESS

WHEN you specify INFILCO Sewage Treatment Equipment, you get more than just equipment. Actually, you specify over 50 years experience in the design and manufacture of a *complete range* of water, sewage and waste treatment equipment.

You have *one source* to depend upon for experience in both chemical and biological treatment . . for the major equipment items as well as the important control devices. And by providing a *complete range* of sewage treatment equipment INFILCO offers the all-important advantage of *undivided responsibility!*

A complete laboratory and staff of competent engineers are available for making recommendations and reports to the consulting engineer or his client. It is, of course, intended that this service shall cooperate with the work of your engineers. When considering your next sewage treatment plant, or the modernization of an existing one, call in your nearest INFILCO Field Engineer, or write our executive offices in Tucson.



**SEND FOR . .**

*Bulletin No. 60-C. It illustrates and describes many items of Infilco Equipment.*

**INFILCO**

• BETTER WATER CONDITIONING AND WASTE TREATMENT SINCE 1894 •

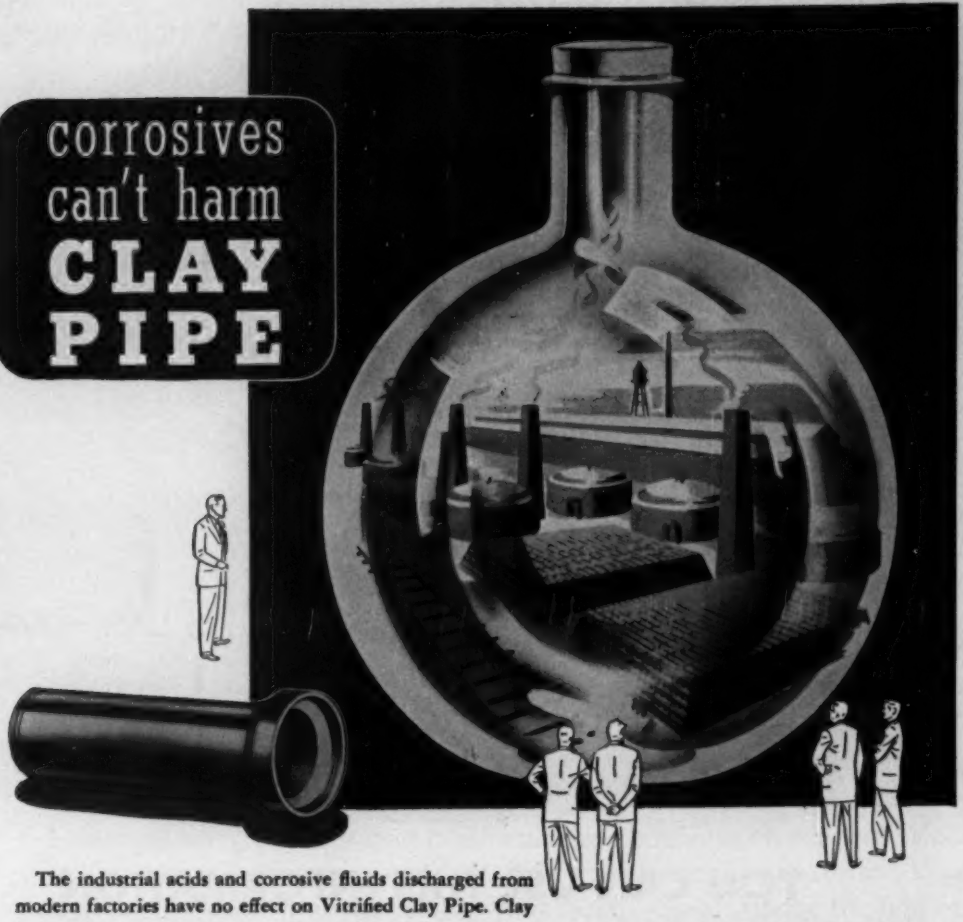
**INFILCO INC.**

NEW YORK 17 • **TUCSON** • CHICAGO 16

SALES OFFICES IN TWENTY SIX PRINCIPAL CITIES

WORLD'S LEADING MANUFACTURERS OF WATER CONDITIONING AND WASTE TREATING EQUIPMENT

# corrosives can't harm CLAY PIPE



The industrial acids and corrosive fluids discharged from modern factories have no effect on Vitrified Clay Pipe. Clay is completely immune to any form of corrosive chemical activity, whether it's sewer gas, industrial waste, or the destructive acids found in sewage. Today, with chemistry involved in nearly half the nation's total production, it's more important than ever to install sewerage and drainage lines that are chemically inert — proof against the acids and soil conditions of today . . . and of tomorrow. *Every* city of *every* size needs Vitrified Clay Pipe — the *only* pipe that never wears out.

**NATIONAL CLAY PIPE MANUFACTURERS, INC.**
180 N. LaSalle St., Rm. 2100, Chicago 2, Ill.
256 Connally Bldg., Atlanta 3, Ga.
703 Ninth & Hill Bldg., Los Angeles 15, Calif.
311 High Long Bldg., 5 E. Long St., Columbus 15, Ohio

**SPECIFY** *Vitrified* **CLAY PIPE**

CLAY PIPE DATA

**WRITE FOR DETAILED INFORMATION**

Additional information and data on Vitrified Clay Pipe, Wall Coping and Clay Flue Lining sent FREE on request. State your specific questions. Simply contact the regional office nearest you.

*Chemicals you live by*

# YOU CAN USE THIS INFORMATION

**Data in the New DIAMOND CHLORINE HANDBOOK includes charts and tables on:**

1. Enthalpy (heat content) of $Cl_2$
2. Pressure drop of $Cl_2$ in pipe lines
3. Solubility of $Cl_2$ in water and other solvents
4. Specific Volume of $Cl_2$
5. Vapor Pressure of $Cl_2$
6. Density of $Cl_2$

For the first time, accurate and comprehensive data on the enthalpy of liquid chlorine has been developed. It is presented in a chlorine reference handbook published by DIAMOND ALKALI. Many new charts and tables on the fundamental properties of chlorine are also included in this handbook.

If you are a chemist or an engineer working with or studying chlorine, you will find here a wealth of usable information. Send for your copy today.

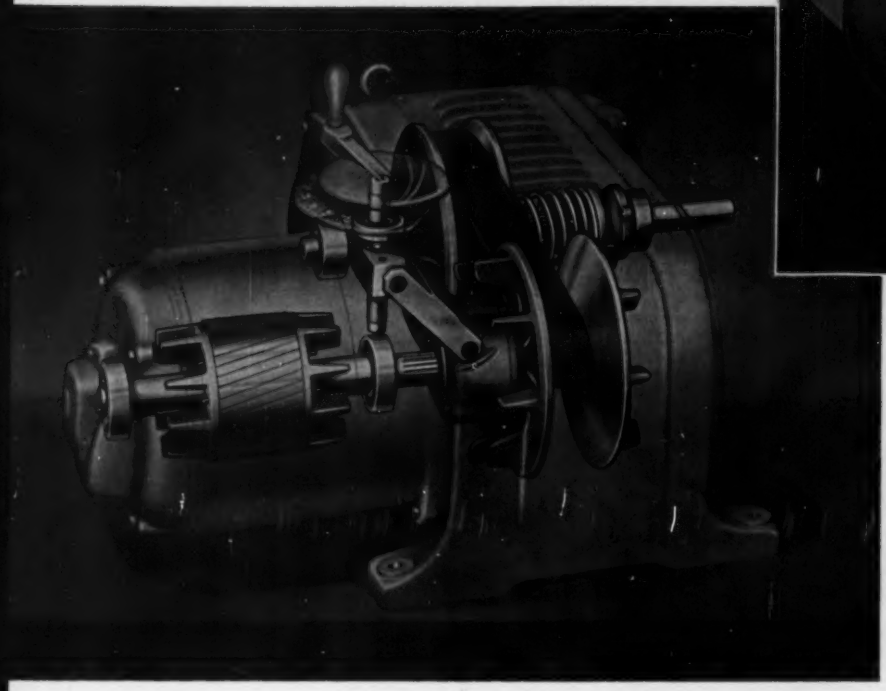
***For your copy, write on your business letterhead to* DIAMOND ALKALI COMPANY, 300 Union Commerce Bldg., Cleveland 14, O.**

**DIAMOND CHLORINE**

DIAMOND ALKALI COMPANY • CLEVELAND 14, OHIO

DIAMOND ALKALI CHEMICALS

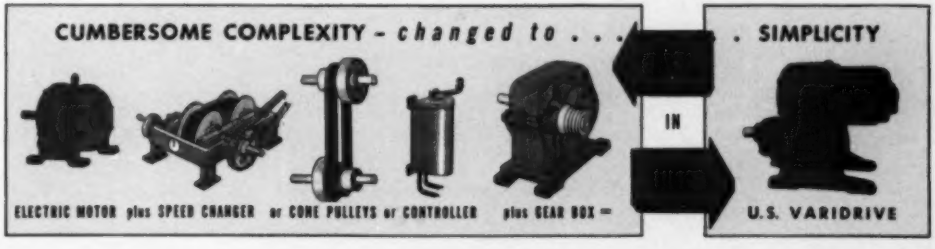
# *Command any speed...*



**ANY SPEED**
**ANY TIME**
**WITH**
**ANY LOAD**

Thousands of speeds are attainable with the U. S. Varidrive Motor. You don't have to buy costly, cumbersome gear-changing apparatus. You don't have to take time out to stop your machine and change the belt in cone pulleys. The Varidrive instantly changes to the exact speed needed for your work by turning the convenient control handle. You improve your work. You increase production. Actual savings will pay for the Varidrive in a short time and earn you increased profits continually.

## U. S. VARIDRIVE MOTORS


CUMBERSOME COMPLEXITY - changed to . . .
. SIMPLICITY
IN
ELECTRIC MOTOR plus SPEED CHANGER or CONE PULLEYS or CONTROLLER plus GEAR BOX —
U.S. VARIDRIVE

*. . . a tip to the very wise—buy Varidrives*

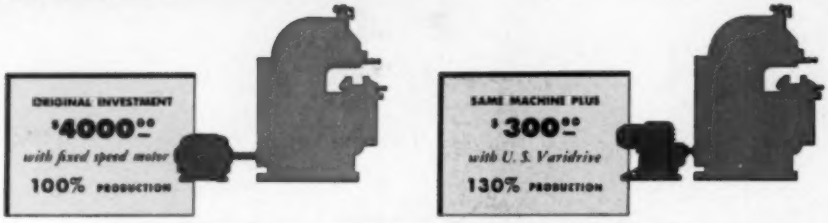
*(See next page)*

Type VEV-GD, U. S. Varidrive-Syncrogear

# U.S. VARIDRIVE

**COSTS ONLY FRACTION OF DRIVEN MACHINE**

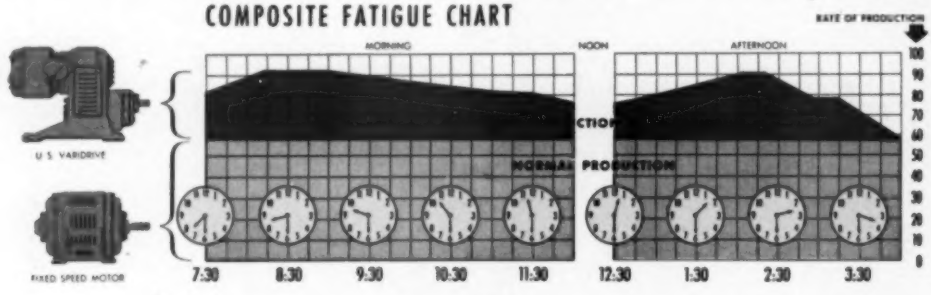
**INCREASES OUTPUT 10% - 20% - 30% OR MORE**




## MAKING YOUR MACHINES GIVE BONUS PRODUCTION

Many machines do not operate at top efficiency simply because the proper speeds are not available. A Varidrive in place of a constant speed motor provides an infinite number of speeds for instant selection. The cost of a Varidrive is usually a small fraction of the total investment in machinery, factory space and overhead. These same facilities can and will provide a *bonus* in production or quality of product if given the opportunity to operate at top efficiency under all conditions. A cost study of countless Varidrive installations reveals that the added investment averages about 10 per cent of the value of the driven machine, but the increase in production capacity runs up to 30 per cent, even higher in many instances. You gain a flexibility of control in your machine which no fixed speed motor can give. Therefore, Varidrive gives your operator both the incentive and means of turning out better work and stepping up his production. You get the *most* out of your machine.

## COMPOSITE FATIGUE CHART




## *Varidrive keeps in step with operator needs*

Human ability varies greatly. Fatigue is an important element which causes variation throughout the working day. A production process must never exceed a worker's ability or the result may be spoiled work or accidents. A fixed motor speed must, therefore, be chosen for the minimum ability for the day. The chart above is an example of the variation compiled from records of many workers. It is obvious that for maximum efficiency the rate of production should be adjusted to the needs of the operator. The Varidrive's speed can be synchronized to the operator's rhythm of action, thereby helping him attain maximum daily output without over-exertion.

*For the complete Varidrive story, ask for Bulletin 1515*

## U.S. ELECTRICAL MOTORS Inc.

**PACIFIC PLANT: Los Angeles 54, California** **ATLANTIC PLANT: Milford, Connecticut**

**Atlanta 3, Ga.; Bakersfield, Calif.; Boston 16, Mass.; Chicago 8, Ill.; Cincinnati 16, Ohio; Cleveland 14, Ohio; Dallas 9, Texas; Detroit 2, Mich.; Fresno 1, Calif.; Houston 4, Texas; Indianapolis 4, Ind.; Milwaukee 2, Wisc.; Minneapolis 2, Minn.; New York City 6, N. Y.; Philadelphia 2, Pa.; Pittsburgh 2, Pa.; San Francisco 7, Calif.; Seattle 4, Wash. » » » » *Distributors and Agents in all principal cities.***

# NEW YORK

## BOARD OF WATER SUPPLY

## Hudson River Pumping Plant

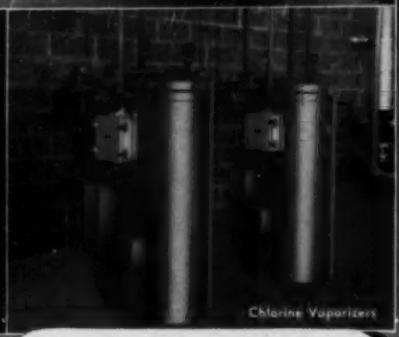
(COMPLETED IN 1951)

Board of Water Supply
City of New York
120 Wall Street — New York

Chas. T. Main, Inc.
Consulting Engineers
Boston, Mass.

Tuller Construction Company
General Contractors
Red Bank, N. J.

Chlorinizer Remote Control Cabinets



Chlorine Vaporizers

New York was a drought-stricken city when construction was started on this emergency pumping plant. The new plant serves solely as a stand-by installation, ready, when needed, to supplement the regular city water supply with 100 MGD of chlorinated water from the Hudson River.

Water is drawn through a 72" intake conduit (intake crib 660 feet off shore in water 54 feet deep) into the Hudson River Pumping Plant where it is effectively chlorinated, metered, and discharged into the reservoir system through the Delaware Aqueduct. Builders Chlorinizers were approved by the engineers and installed by the contractors to perform this vital chlorinating job. A 54" x 32" Builders Venturi Meter indicates, totalizes, and records the plant output. For Bulletins and information on Builders water works equipment, address Builders-Providence, Inc. (Division of Builders Iron Foundry), Providence 1, R. I.

**Builders water works equipment furnished for the Hudson River Pumping Plant:**

- **2 — 6000#/24 hr. capacity Model CGS Gravimetric Type, Remote Control, Solution Feed Chlorinizers for disinfecting station discharge**
- **2 — 8000#/24 hr. capacity Vaporizers to supply gaseous chlorine to Chlorinizers**
- **1 — 54" x 32" Model VT54 Venturi Tube with Type M Register-Indicator-Recorder**

BIF INDUSTRIES

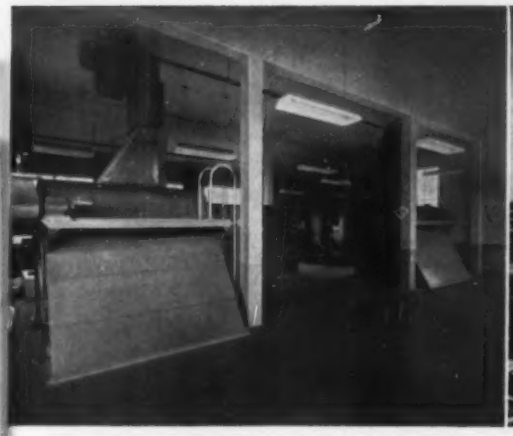
**BUILDERS-PROVIDENCE**

BUILDERS

# for top performance

## MODERN PLANTS CHOOSE REX

for example
PORTLAND, OREGON
Consulting Engineers:
Stevens & Koon
John W. Cunningham & Associates
Portland Sewerage Project
Portland, Oregon



*Rex Combination Bar Screens and Triturators*

*4 primary tanks equipped with 12 Rex Longitudinal Sludge Collectors, 4 Rex Cross Collectors, and 12 Rex Worm Gear Operated Scum Collecting Pipes.*

Here's another example of Rex Equipment being chosen as "best for the job" in an up-to-date sewage plant. In plant after plant, Rex has proved its ability to render years of trouble-free service at low overall cost. This is the principal reason why an ever-increasing percentage of new installations specifies Rex wherever possible.

At the Portland, Oregon, plant the following Rex equipment was selected: 2 type MAX Mechanically Cleaned Bar Screens in combination with 2 No. 8 F Triturators for 2 channels each 9′0″ wide x 9′9″ deep; 12 longitudinal sludge collectors, 4 cross collectors and 12 worm gear operated scum collecting pipes for 4 primary tanks, each 58′ wide by 236′ long by 9′9″ water depth. Each bar screen is automatically operated by a pneumatic differential indicator-controller. Each triturator has a capacity of 60 cu. ft. of screenings per hour. The plant is designed to handle 40 MGD minimum, 60 MGD average and 155 MGD maximum.

Get all the details on the complete line of Rex Sewage Treatment Equipment. Call your nearest Rex Field Sales Engineer or write for Bulletin 51-83. Chain Belt Company, 1610 W. Bruce St., Milwaukee 4, Wis.

CHAIN BELT REX COMPANY ®

SEWAGE TREATMENT EQUIPMENT . . .

# a "Big Inch" of olden days ~

**GENIUS has raised her head in every age. So today's Masterbuilders are but the projeny of antiquity's great inventors. Even principles are related. An example of this is the plug cock design for fluid control, embodied in the Smith Rotovalve, which has come down through the ages unchanged! Send for your copy of "Rotovalves by Smith."**

*If It's Hydraulics - Put It Up to Us!*

## S. MORGAN SMITH Co.

YORK, PENNA. U.S.A.

# *When pipe life is too short...**

The age-old problems of maintenance and replacement are solved when you specify CARLON plastic pipe for municipal water systems, sewage disposal, land drainage and other medium-pressure, low temperature applications.

CARLON plastic pipe is guaranteed against rot, rust and electrolytic corrosion. It will not accumulate scale or sediment, is inert to the action of corrosive soils and waters, and features a projected service life many times longer than ordinary pipe.

CARLON plastic pipe is furnished in random 21-foot threaded and coupled sections. To meet individual job requirements, this new CARLON plastic pipe can be cut to desired length and threaded with standard pipe dies.

A complete line of CARLON plastic fittings, reducers and plugs is available to permit complete corrosionproof plastic installations as well as connection to fixtures and previously installed metallic lines.

When pipe life is too short, eliminate costly maintenance and replacement problems . . . Specify CARLON—The first real pipe that is plastic!

At present, raw material shortages are limiting the production of certain types of CARLON pipe. Every effort is being made, however, to overcome this problem and to meet the demand and need for CARLON plastic pipe.

*** SPECIFY CARLON—the first real pipe that is plastic!**

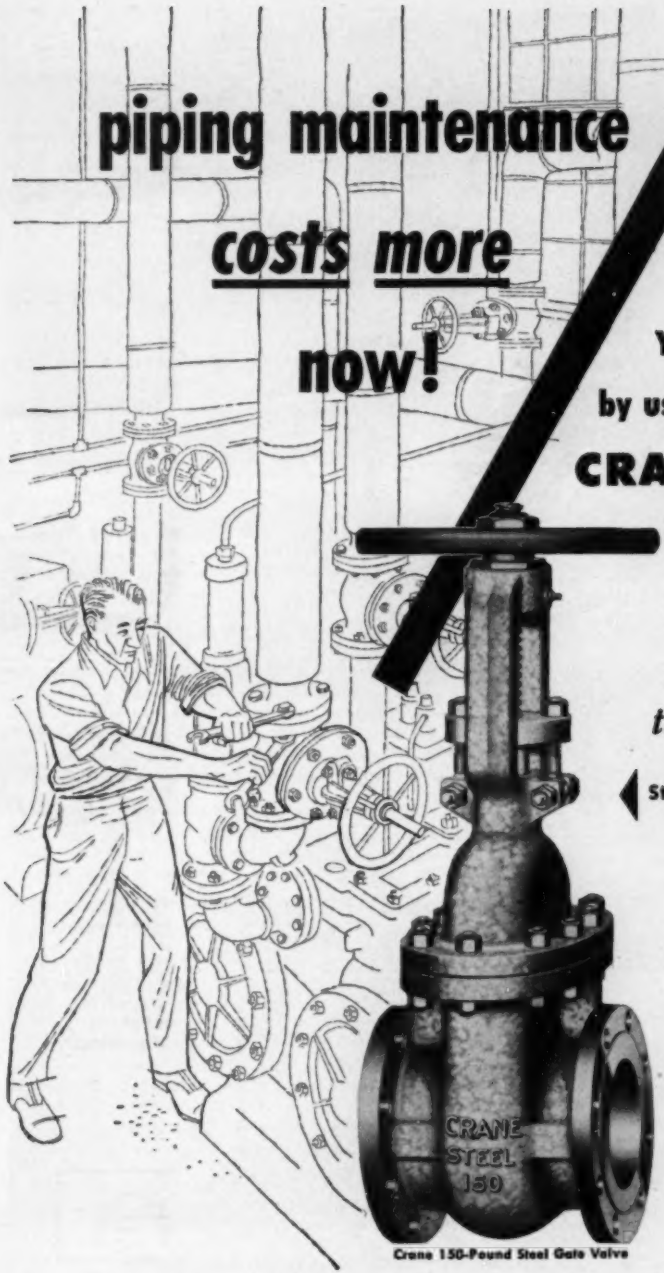
CARLON CP 128-CP

## CARLON PRODUCTS CORPORATION

IN CANADA: MICRO PLASTICS, LTD., ACTON, ONTARIO

10132 MEECH AVENUE • CLEVELAND 5, OHIO

# piping maintenance *costs more* now!




Crane 150-Pound Steel Gate Valve

**You spend less for it by using Dependable Quality**

## CRANE VALVES

*. . . That's why more Crane Valves are used than any other make*

**Steel valves that stay on the job**

You can practically forget valve maintenance worries with Crane Cast Steel Wedge Gates. They're unusually rugged . . . amply reinforced at all stress points. Disc is precision-guided to reduce seating surface wear. Straight-through ports give smooth flow, with minimum turbulence and erosion.

Stuffing box depth and design assure tight stem seal...long packing life. Valves available in trim materials for steam, water, gas, oil, and oil vapor services.

**Ask your Crane Representative about the better quality and greater dependability of Crane valves—your assurance of on-the-job performance that spells lower final cost.**

# CRANE

CRANE CO., *General Offices:*
836 S. Michigan Ave., Chicago 5, Ill.
*Branches and Wholesalers Serving All Industrial Areas*

**VALVES • FITTINGS • PIPE • PLUMBING • HEATING**

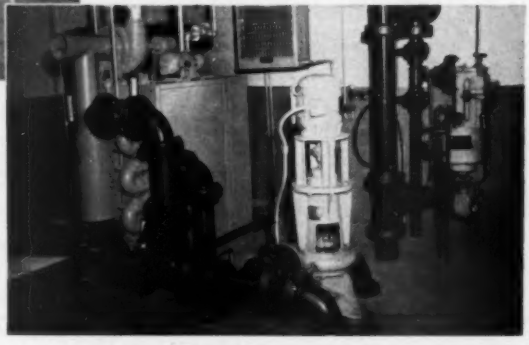
# SEDALIA MISSOURI GOES MODERN

The three waste treatment plants at Sedalia, Missouri—the North, West and South plants—have been completely modernized, utilizing all existing structures and equipment where economies in contruction could be effective.

NORTH PLANT P.F.T. Controlled Digestion System with 2 - 30' floating covered digesters and #170 digester heater is included in this plant which utilizes the existing Imhoff tank as a secondary clarifier, also providing a new trickling filter to supplement the old P.F.T. fixed nozzle unit.

WEST PLANT The P.F.T. Controlled Digestion System at this plant was developed by modernizing two existing unheated digesters with scraper mechanisms with two P.F.T. floating cover digesters and supplying heat with a P.F.T. #170 heater. The existing P.F.T. fixed nozzle filter and final clarifier were used without change.

SOUTH PLANT A completely new P.F.T. Contolled Digestion System with a 35' P.F.T. floating cover and #100 digester heater replaces the old septic tank at this plant. The old contact filters were converted to sludge beds.



All three plants now embody the ultimate in modern "P.F.T. Controlled Digestion" systems including P.F.T. floating covers, P.F.T. supernatant selectors, P.F.T. digester heaters and P.F.T. gas safety equipment. All three digester heaters are also arranged to automatically supply the building heating requirements.

*Burns & McDonnell Engineering Co., Kansas City, Mo., were the Consulting Engineers on this project.*

P.F.T.

**PACIFIC FLUSH TANK CO.**

*Waste Treatment Equipment Exclusively Since 1893*

**4241 RAVENSWOOD AVE. CHICAGO 13, ILLINOIS**

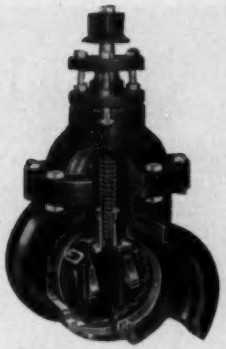
NEW YORK • LOS ANGELES • SAN FRANCISCO • CHARLOTTE, N. C. • JACKSONVILLE • DENVER

# IOWA products

## meet your most exacting specification

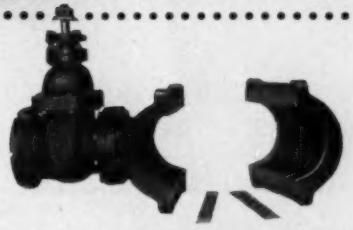
Superiority of Design, Workmanship, and Materials Assures Efficient Trouble Free Operation . . .

*In every job*



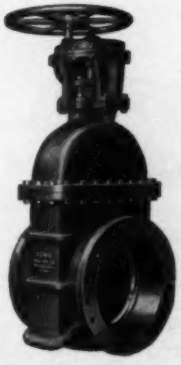
**IOWA GATE VALVES**—Simple, rugged construction, fully bronze mounted. Parallel seat, double disc type with independent solid bronze wedges and stem nut. Trouble free service assured.

**IOWA CHECK VALVES**—Balanced swing type, bronze trimmed throughout. Equipped with stainless steel hinge pin. Furnished with rubber or leather faced disc if desired. For installation in either horizontal or vertical pipe lines. Extremely low loss of head.



**IOWA TAPPING SLEEVES and VALVES**—Sturdily built, easy to assemble and center on pipe. All bolted type with lead strips for tight sleeve connections. Extra long body sleeves with heavy flanges amply protect the cut. All sizes available.

**IOWA FIRE HYDRANTS**—Latest Corey type conforming to AWWA specifications. Will not geyser when standpipe is broken. Unique design provides unrestricted water flow with extreme low loss of head.



**IOWA SQUARE BOTTOM VALVES**—Specially designed for throttling service in filter wash and pump discharge lines. Square bottom features can be built into gate valves of any pressure ratings.

**IOWA HYDRAULIC VALVES**—Superiority of design matched with sturdy construction meets severe, continuous filter service requirements. Available with either iron, brass lined or brass tubing cylinders.

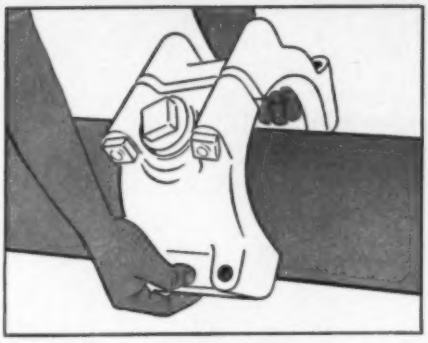
**IOWA SLUICE GATES**—Heavy cast iron construction, fully bronze mounted. Provided with solid bronze adjustable wedges. Suitable for seating and unseating pressures. Wide range of sizes.

*Write today for descriptive literature.*

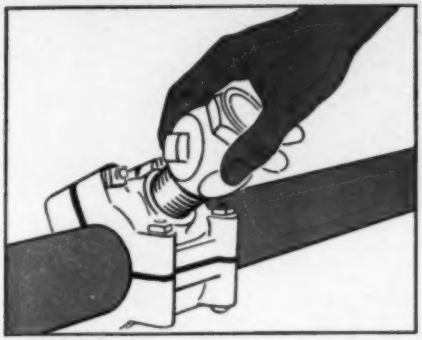
**IOWA VALVE COMPANY**

201-299 N. Talman Ave., Chicago 80, Ill. • *A Subsidiary of James B. Clow & Sons*

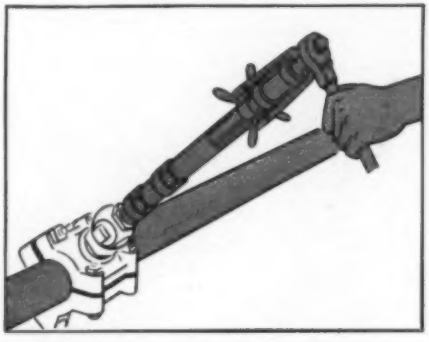
# EASY WAY TO MAKE A 2" tap on a 4" main



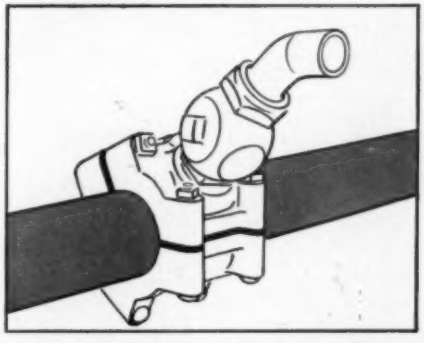
**1.** ***Fit Dresser Style 82 Sleeve on the pipe.*** This low-cost sleeve is easily installed, requires no caulking, is permanently bottle-tight.



**2.** ***Insert 2" corporation stop*** in the threaded vent of the sleeve. (Vented sleeve section furnished with corporation tap if specified.)



**3.** ***Drill pipe with tapping machine*** conventionally used for drilling through corporation stops.



**4.** ***Run Service*** according to your usual practice. Rubber packed sleeve assures lifetime flexibility at the main.

This method permits tapping a main under pressure, and is vastly simpler than siamesing several small taps together. It provides flexibility, eliminates the use of several corporation stops and requires only one drilling operation. Save time, save money—make all your larger taps with Dresser "Adjustable" Sleeves. *Write today for literature and prices.*

## DRESSER "ADJUSTABLE" SLEEVES

Dresser Manufacturing Division, 59 Fisher Ave., Bradford, Pa. (One of the Dresser Industries) • In Texas: 1121 Rothwell St., Houston
In Canada: 629 Adelaide St., W., Toronto, Ont. • Sales offices: New York, Chicago, Houston, San Francisco

# Fluoridation News

1945 1951

## IN TEXAS, TOO—

CITY OF MARSHALL

MARSHALL, TEXAS

January 24th, 1951

Wallace & Tiernan Co. Inc.
1112 National City Bldg.
Dallas 1, Texas

Gentlemen:

The City of Marshall, Texas began fluoridation of its municipal water supply in the Spring of 1946, under the jurisdiction of the Texas State Health Department. Marshall was the first city in the State of Texas to use fluoridation.

In February 1950, we changed our method of fluoridation by feeding sodium fluoride with a Wallace & Tiernan Type MA Dry Chemical Feeder.

We have found the Wallace & Tiernan Type MA Feeder to be simple in operation, easy to adjust and maintain, and extremely accurate for feeding sodium fluoride. We have been able to hold the fluoride content of our treated water very constant by using this feeder.

We would be glad to recommend this feeder to any town considering adding fluorides to the public water supply.

Very truly yours,

CITY OF MARSHALL
J. W. Schonhardt
J. W. SCHONHARDT
Water Superintendent

When *your* community is ready to look into fluoridation — and after you have consulted your State Department of Health — you'll find W&T Engineers ready and willing to help you.

WISCONSIN

WALLACE & TIERNAN
COMPANY, INC.
CHLORINE AND CHEMICAL CONTROL EQUIPMENT
NEWARK 1, NEW JERSEY • REPRESENTED IN PRINCIPAL CITIES

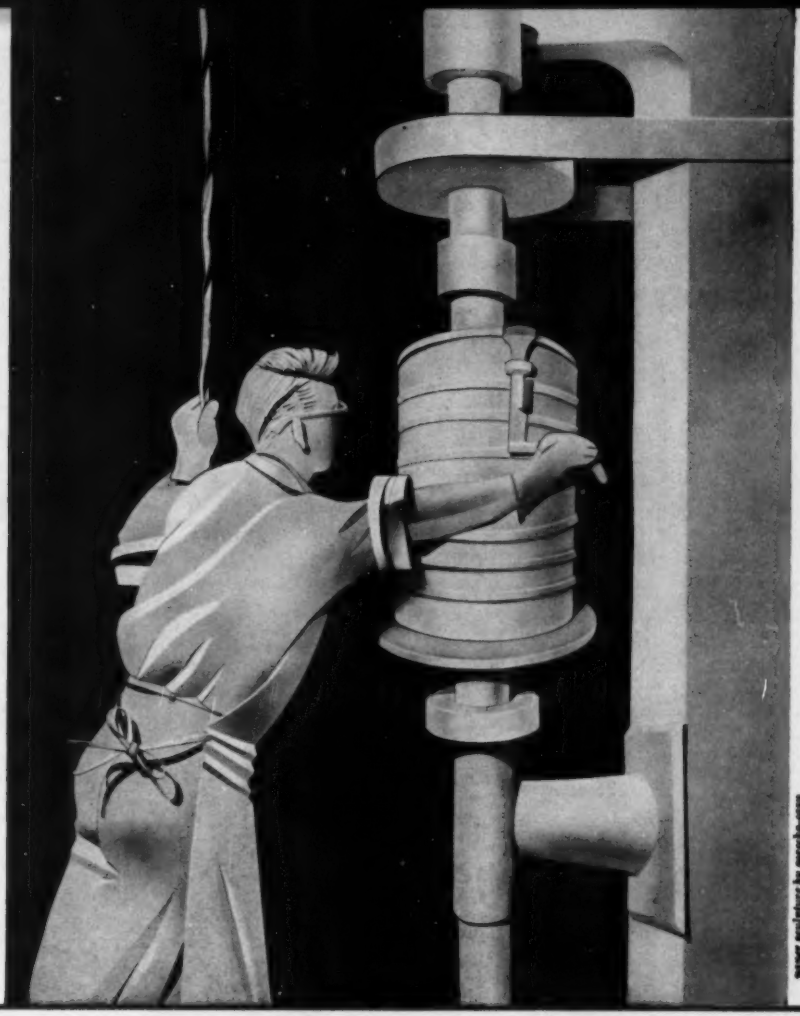
*New Orleans' famed Cabildo and Cathedral of St. Louis in the Vieux Carré as seen 100 years ago*

New Orleans has a cast iron gas main in service that was installed well over 100 years ago. Vehicular traffic in those times was a far cry from today's giant buses and trailer trucks. The engineering term—*traffic shock*—was then unheard of. There were no sewers, conduits and other underground services to cause soil disturbance. Yet this old cast iron main has had the shock-strength, beam-strength and effective resistance to corrosion to withstand the changes and unforeseen stresses of more than a century. New Orleans' experience is not exceptional. Cast iron water and gas mains, laid over a century ago, are still serving in the streets of more than 30 cities in the United States and Canada.

**United States Pipe and Foundry Co.,**
**General Offices, Burlington, N. J.**
**Plants and Sales Offices Throughout the U. S. A.**

**U.S.**
**cast iron**
**PIPE**

NUMBER SIX OF A SERIES




# a drum you can't beat

to maintain the quality of its products in transit, Niagara manufactures its own drums . . . assurance to you that Niagara chemicals and their containers are always dependable.

- NIALK* Liquid Chlorine
- NIALK Caustic Potash
- NIALK Carbonate of Potash
- NIALK Paradichlorobenzene
- NIALK Caustic Soda
- NIALK TRICHLORethylene
- NIAGATHAL* (Tetrachloro Phthalic Anhydride)

*Trade-mark

**NIAGARA ALKALI COMPANY**

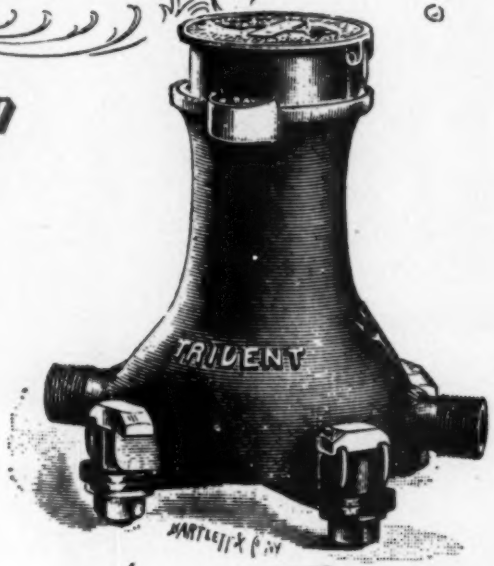
60 East 42nd Street, New York 17, New York

# TRIDENT Meters

## "ANTIQUE"

*—but never*

## OBSOLETE!




You can take an "antique" Trident Meter—made as long as 50 years ago—and make it BETTER THAN WHEN IT WAS NEW—simply by inserting today's new improved interchangeable parts.

Neptune's policy of Interchangeability guarantees that Trident Meters, while they may become "antique," NEVER BECOME OBSOLETE . . . their accuracy can always be renewed.

## NEPTUNE METER CO.

227

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WATER & SEWAGE WORKS

VOL. 98, NO. 6 • A GILLETTE PUBLICATION • JUNE 1951

# Miami Host to 71st AWWA Convention

**Retiring President**
*W. Victor Weir*
*President*
*St. Louis Co. Wat. Co.*
*St. Louis, Mo.*

**Incoming President**
*Dr. A. E. Berry*
*Director*
*Div. San. Engng.*
*Ont. Min. H'lth*
*Toronto, Ont., Can.*

**Officers of the American Water Works Assn.**

**Vice President**
*Chas. H. Capen*
*Ch. Engr.*
*No. Jer. Wat. Dist.*
*Wanaque, N.J.*

**Treasurer**
*W. W. Brush*
*Editor*
*Wat. Wks. Eng.*
*New York City*

**Secretary**
*Harry E. Jordan*
*AWWA*
*New York City*

**Exec. Asst. Secy.**
*Ray J. Faust*
*AWWA*
*New York City*

IT wasn't the largest convention the AWWA has ever held, but it certainly was one of the best and Miami, Fla. and the Florida Section can both take a bow for the part they played in hosting the 71st AWWA Convention. Beautiful weather, good exhibit hall facilities, and an excellent program combined to make this meeting one of those to remember.

As usual, much interest was evidenced in the registration and this reporter, too, followed the statistical record for the benefit of our readers who may have missed the meeting. Whereas last year, Sunday saw a registration of 616, this year a different pattern was set with 945 and it looked as though the record would be smashed with ease. Monday, too, hit another high when the number of registrants rose to 1792 compared to last year's 1595, but Tuesday was a disappointing day at the registration desk as were Wednesday and Thursday. When Tuesday's number climbed slowly to 1871 it was obvious that persons who came to this convention were coming early. Only twenty-five persons registered on Wednesday and 10 more on Thursday to bring the grand total up to 1906, just 101 less than last year and 61 less than the year before.

Of those who registered, and as usual there were some persons who didn't register, approximately 500 were ladies. This number was roughly 175 more than at Philadelphia, which means, of course, that men registrants were decidedly fewer than last year. But it was still a good convention. At least, the 76 exhibitors, who occupied 131 booths, all seemed to think it was a successful meeting and the good attendance and good attention at the 14 different sessions likewise attested to the success of the meeting.

Once again, badges or lapel labels came in three colors, white for members who had attended previous conventions, green for newcomers, and buff for manufacturers representatives. Once again, too, the number of green badges was exceedingly small. Presiding over the registration desk was Eric Johnson, Asst. Secy. of the association while Mrs. Lois Schultz, AWWA Membership secretary manned the information desk. In the temporary office of AWWA, transplanted for the meeting to the Dinner Key Convention Hall, were Harry Jordan, Ray Faust and Miss Mary E. Rodgers so that, not only the convention business, but association business proceeded during the week.

*Chas. R. Cox*
*Chief*
*Wat. Sup. Sect.*
*St. H'lth Dept.*
*Albany, N.Y.*

**New Honorary Members**

*S. B. Morris*
*Gen. Mgr.*
*Wat. & Pow. Dept.*
*Los Angeles*
*Calif.*

*S. T. Powell*
*Cons. Engr.*
*Baltimore*
*Md.*

**Diven Medal**
*Wendell LaDue*
*Ch. Engr. & Mgr.*
*Wat. & Sew.*
*Akron, O.*

### Entertainment

Following the customary pattern, Sunday night was Meet and Greet Night (in the words of "Rick" Johnson, AWWA Journal Editor), Monday night was the President's Reception and Dance ("Brass and a Band"), Tuesday night was Award Night with entertainment by the Choral Belles, a Miami Ladies Glee Club. On Wednesday night, a variety show entertained those who were not occupied elsewhere, and on Thursday night the annual Dinner and Dance brought 850 persons to the Municipal Auditorium, where all of the evening functions were held, except the Sunday night Get-together.

In addition, a gold tournament drew 96 players including ten ladies. Available for all ladies was an afternoon tea, a delightful and delightfully cool two

*C. F. Wertz*
*Res. Engr.*
*Wat. Dept.*
*Miami, Fla.*
*(Management)*

*E. A. Sigworth*
*Tech. Sales*
*"Nuchar"*
*New York City*
*(Transportation)*

*A. P. Black*
*Hd., Chem. Dept.*
*Univ. of Fla.*
*Gainesville, Fla.*
*(Reception)*

*T. T. Quigley*
*Adv. Mgr.*
*Wallace & Tiernan*
*Newark, N.J.*
*(Entertainment)*

**Convention Committee Chairmen**

hour boat trip around Miami Bay, and a bus tour past the landlocked sights of Miami to Crandon Park, where famous Burdine's held a fashion show of play clothes and casual wear. Chairman of the General Entertainment Committee was T. T. QUIGLEY, Adv. Mgr., Wallace and Tiernan, Inc., Newark, N.J., ably assisted by Messrs. Black, Boyce, Glass, Hoy, Keller, Wells, and Wertz of the Florida Section.

## AWWA Officers

At the close of the annual banquet, W. VICTOR WEIR, retiring AWWA President, paid tribute to the staff and officers of AWWA for the success of his administration. He then introduced the incoming officers:

*President*
Dr. A. E. Berry, Director
Sanitary Engineering Div.
Ontario Ministry of Health
Toronto, Ont., Canada

*Vice President*
Charles H. Capen, Chief Engr.
No. Jersey Dist. Water Supply Comm.
Wanaque, N.J.

*Treasurer*
Wm. W. Brush, Editor
Water Works Engineering
New York City

*Secretary*
Harry E. Jordan
New York City

*Exec. Asst. Secy.*
Raymond J. Faust
New York City

Retiring President Weir received a handsome desk set in recognition of his year of service.

## Honors and Awards

Before a large audience in the Municipal Auditorium on Tuesday night, President Weir, assisted by Vice President elect Capen presented the several awards and trophies which annually go to persons or sections in recognition of some certain accomplishments.

Three AWWA members were presented with HONORARY MEMBERSHIPS:

*Charles Raymond Cox*, Chief, Water Supply Section, Bureau of Environmental Sanitation, New York State Health Dept., Albany, N.Y.; a member of the Association since 1921; Fuller Awardee; Director of New York Sect., 1941-44; Chairman, N.Y. Section, 1940-41; Secretary Water Purif. Div., 1935-47; Chairman, Water Purif. Div., 1948; active in the revision of the U.S.PHS Drinking Water Standards and the AWWA Manual of Water Quality and Treatment.

*Samuel Brooks Morris*, Gen. Mgr. and Ch. Engr., Los Angeles Dept. of Water and Power; previously Dean of Engineering of Stamford University. Member of the Association since 1920; Diven Medal, 1933; President of Association, 1944; Director Calif. Sect. 1930-33; Secretary Calif. Sect., 1923-25; Member of the AWWA Comm. of National Water Policy; and Member of the President's Commission on Water Resources Policy.

*Sheppard Tappen Powell*. Consulting Engineer, Baltimore, Md. Member of the Association since 1906; Fuller Award, 1947; Chairman, Water Purification Div., 1935; active in the revision of Standard Methods of Water Analysis and contributor to the revision of the AWWA Manual of Water Quality and Treatment.

The DIVEN MEDAL was awarded to *Wendell Richard LaDue*, Chief Engr. and Manager, Water Sewage Works Dept., Akron, Ohio, for his conduct of the activities of the Committee on Water Works Administration; his service as General Chairman of the Committee since its organization in 1947; his selection of key men for sub-committee leadership; and his stimulation of committee work—all of which have brought credit to him and the Association.

The GOODELL PRIZE with its cash award was presented to *Malcolm Strong McIlroy*, Prof. of Electrical Engineering, Cornell University, Ithaca, N.Y., for his paper entitled, "Direct Reading Electrical Analyzer for Pipe Line Networks" which was published in the April 1950 issue of the AWWA Journal. The citation read, "The research work done in connection with the development of the analyzer was of the highest order and the value of the results will continue to be of great importance to the profession. Professor McIlroy is to be highly commended for his lucid presentation of such a difficult subject.

Twenty-five FULLER AWARDS were presented at the meeting and seven-

*M. R. Boyce*
*Pres.*
*Boyce Co.*
*Clearwater, Fla.*
*(Dinner)*

*D. B. Lee*
*Ch. Engr.*
*St. H'lth Dept.*
*Jacksonville, Fla.*
*(Host)*

*H. H. Hyman*
*So. Div. Mgr.*
*Fla. Pow. & Light*
*Miami, Fla.*
*(Loc. Transp.)*

**Convention Committee Chairmen**

*F. P. McDonald*
*Mgr.*
*Electro Rust Proofing*
*Chicago, Ill.*
*(Golf)*

*S. K. Keller*
*Gen. Supt.*
*Pinellas Wat. Sys.*
*Clearwater, Fla.*
*(1st Timer Host)*

teen of the recipients were on hand to receive the certificate in person. The list of awardees included: George Hansel Godwin (Alabama-Mississippi), Dario Travaini (Arizona), Wilfred Francis Langleier (California), Ira Percy McNab (Canadian Section), William Dennis Collins (Chesapeake), Manuel J. Puente (Cuba), Thomas Paul (Florida), Jesse John Woltmann (Illinois), Howard William Niemeyer (Indiana), Edward Bartow (Iowa), Robert Harlan Hess (Kansas), Jack Ellis Cooper (Michigan), Nathan Thomas Veatch (Missouri), James R. Cortese (Montana), Karl Raymond Kennison (New England), C. B. Tygert (New Jersey), Linn Harrison Enslow (New York), Robert Stanley Phillips (North Carolina), Luther Thomas Fawcett (Ohio), Winston Headly Berkeley (Pacific Northwest), Carleton Emerson Davis (Pennsylvania), Robert Brittain Simms (Southeastern), John Henry O'Neill (Southwest), Percy Harold McGaughey (Virginia), Paul Dudley Simmons (West Virginia), and Oswald John Muegge (Wisconsin).

### Cup Winners

The HILL CUP, emblematic of membership growth, was presented to the Kansas Section which had a point score of 40.96. The Florida Section was second in the competition with a point score of 34.82; and the Indiana Section was third with a point score of 33.48.

The HENSHAW CUP award for the year 1950, was awarded to the Canadian Section which had 68.9 per cent of its members in attendance at its annual meeting. The Rocky Mountain Section was second with 63.4 per cent of its members present and the Montana Section came in third with a score of 62.1 per cent.

For the 13th time, the OLD OAKEN BUCKET, emblematic of the largest membership went to the California Section, with 916 members at the end of last year; second was New York with 666 members and third was the Southwest Section with 617 members.

*Ed. S. Hopkins*
*Prin. Assoc. Engr.*
*Bur. Wat. Sup.*
*Baltimore, Md.*
*(Chesapeake)*

**New AWWA Directors**

*E. R. Stapley*
*Dean, Engng.*
*Okla. A & M*
*Stillwater, Okla.*
*(Southwest)*

*R. A. Thums*
*Supt.*
*Filtration*
*St. Paul, Minn.*
*(Minnesota)*

The GOLF TROPHY this year went to S. S. Gregory, Treasurer and Auditor, Kentucky Water Service Co., with a low gross of 85. First low net went to P. R. Hirsch, Lock Joint Pipe Co., East Orange, N.J. Ladies low gross was won by Mrs. E. M. Jones of Philadelphia, Pa. with a score of 103. First ladies low net went to Mrs. J. R. Hoy of Jacksonville, Fla.

Among the Directors, Prof. Fred Merryfield, (Univ. of Oregon) made the best advance prediction of the registration and thereby won that competition. One other competition, brought on by the desire of the conventioneers to go native and adopt cool comfortable sport shirts, was won by Dana Kepner, Manufacturers Representative of Denver, Colo. who won $5 for the Loudest Sport Shirt among the Board of Directors.

Voting was held on some sixty submitted designs for the AWWA Seal Competition, but the results of the voting were not known at the end of the convention.

### Presidential Address

In his acceptance speech as President, Dr. A. E. (Bert) Berry called attention to the fact that the election of a Canadian to the presidency of the American Water Works Assn. was in itself evidence of the cementing of ties between these two countries and evidence too, of both friendship and neighborliness.

Dr. Berry said that the AWWA is a truly great organization for several reasons: Because it has such grand people in it; because it lives up to its obligations to provide services to its members and to the public; because it has a highly developed and efficient headquarters staff, headed by "Mr. Water Works"; because of its desire to provide the utmost in public services; because the section arrangement is ideal; and because of the Water and Sewage Works Manufacturers Assn.

As to the future of AWWA, Dr. Berry stressed the problems which confront water works men in both our countries: Civil defense; procurement of water, fluoridation, water resources, and technical research. These problems will be met by the working together of all of the factors and and people who go to make up the American Water Works Assn.

## Division Officers

The following officers were elected by the three divisions of the association.

### Water Purification Division

*Chairman*—H. O. Hartung, Asst.

**President**
*R. F. Orth*
*Mgr. "Transite"*
*Johns-Manville*
*New York City*

**Pres. Elect**
*E. M. Jones*
*V. P. & Gen. Mgr.*
*Simplex Valve*
*Philadelphia*

**Manufacturers Association**

**Vice Pres. Elect**
*Carl N. Brown*
*Asst. Gen. Sales Mgr.*
*U. S. Pipe & Fdry.*
*Burlington, N.J.*

**Treasurer**
*Hub. F. O'Brien*
*Pres.*
*A. P. Smith Co.*
*E. Orange, N.J.*

**Manager**
*John Stewart*
*New York*
*City*

**Secretary**
*D. E. Dimmers*
*New York*
*City*

Gen. Mgr., St. Louis Co. Water Co., St. Louis, Mo.

*Vice Chairman*—R. L. Derby, San. Engr., Los Angeles Water and Power Dept., Los Angeles, Calif.

*Secy.-Treas.*—Martin E. Flentje San. Engr., Amer. Water Works Service Co., Philadelphia, Pa.

*Directors*—W. W. Aultman, Water Purif. Engr., Metro. Water Dist. La Verne, Calif.; Wm. Yegen, Supt. of Filt., Bismark, N.D.

### Report of Div. Officers

On April 29, the officers of the three divisions met for a discussion as a single group taking up such topics as pumps, power, mains, tanks, hydrants, meters, automotive equipment, construction equipment, and engineering. These fields had formerly been covered by the old Plant Management and Operating Division which went out of existence a few years back with the creation of the Management Division.

*Secretary*—Miss Dorothy E. Dimmers, New York City.

During the luncheon, a silver loving cup was presented to Edgar J. Buttenheim, Pres., American City Magazine, who retired as Treasurer after 23 years in office.

Speaker at the Manufacturers' luncheon was Frank W. Lovejoy, Marketing and Sales Executive, Socony Vacuum Oil Co., New York City. Mr. Lovejoy made a highly effective and amusing presentation of the thesis that marketing is important; that markets are in the minds of people and that marketers must create in those minds the idea of joy in use of that product.

Mr. Lovejoy emphasized that we must learn to do business under threat of war, depression and government control, whether or not those things ever come to pass. Speaking as a marketing expert, he pointed out that in many instances water works equipment manufacturers failed to dress up their equipment, failed to give it sales appeal.

In this day of specialization, it is essential that one try not to be all things to all people, to learn how to say I don't know, and to refer customers questions to the home office experts, thereby creating a greater respect for both the salesman and the company.

Among his many quotations of the talk, Mr. Lovejoy said, "Business is based on reputation and reputation is not what you are but what people people think you are; reputation takes a long time to build and may be destroyed in a second." "The key to the mass market is competition." "Human nature doesn't change and the key to successful selling is to understand human nature." "People buy from whom they like, not what they like."

There are five rules for selling:

1. Don't talk too much
2. Never assume an argumentative manner

*Paul Weir*
*Gen. Mgr.*
*Water Dept.*
*Atlanta, Ga.*
*(Chairman)*

*M. B. Cunningham*
*Gen. Mgr.*
*Water Dept.*
*Oklahoma City, Okla.*
*(Vice Chairman)*

*J. W. Myers*
*Vice Pres.*
*Phila. Sub. Wat. Co.*
*Bryn Mawr, Pa.*
*(Sec'y-Treas.)*

*N. S. Bubbis*
*Gen. Mgr.*
*Gr. Winnipeg Wat.*
*Winnipeg, Man.*
*(Director)*

*W. A. Glass*
*Director*
*Wat. & Sew.*
*Miami, Fla.*
*(Director)*

**Officers Water Works Management Division**

### Water Resources Div.

*Chairman*—George Ferguson, Staff Officer, Water Resources Branch, U.S. Geological Survey, Washington, D.C.

*Vice Chairman*—Dale Maffitt, Gen. Mgr., Water Works, Des Moines, Iowa.

*Secy.-Treas.*—F. W. Kittrell, Chief. Stream Sanitation Section, Tennessee Valley Authority, Knoxville, Tenn.

*Directors*—Fred Merryfield, Prof. San. Engng., Univ. of Oregon, Corvallis, Ore.; Laurence E. Goit, Ch. Engr. of Water Works and Dep. Gen. Mgr., Water and Power Dept., Los Angeles, Calif.

### Management Division

*Chairman*—Paul Weir, Gen. Mgr., Water Dept., Atlanta, Ga.

*Vice Chairman*—M. B. Cunningham, Supt. & Engr., Water Dept., Oklahoma City, Okla.

*Secy.-Treas.*—J. W. Meyers, Vice Pres. and Supt., Philadelphia Suburban Water Co., Bryn Mawr, Pa.

*Directors*—N. S. Bubbis, Gen. Mgr., Greater Winnipeg Water & San. Dist., Winnipeg, Man., Canada; W. A. Glass, Director, Water and Sewers, Miami, Fla.

### Fuller Award Society

*President*—Dale Maffitt, Gen. Mgr., Water Works, Des Moines, Iowa.

*Secy.-Treas.*—Rollo K. Blanchard, Vice Pres. Neptune Meter Co., New York City.

This group of division officers reported to the Board of Directors that they favored the creation of a fourth division, but could not agree on a name. If such a division is not created the group suggested that the management division temporarily take over these subjects.

The group also reported to the Board that experiences with fluoridation pressure groups throughout the country indicated a need for a more specific AWWA Fluoridation.

The Division officers also recommended a discussion by the Board of Directors on the uniformity of grading and registration of water works personnel.

### WSWMA Meeting

The Annual Meeting of the Water & Sewage Works Mfrs. Assn. was held on Wednesday noon, May, 2. New members elected to serve on the Board of Directors included: Lock Joint Pipe Co., American City Magazine, Roberts Filter Co., Pittsburgh-Des Moines Steel Co., and the Dorr Co. New officers, to take office on Jan. 1, 1952 are:

*President*—E. M. Jones, Vice Pres. & Gen. Mgr., Simplex Valve and Meter Co., Philadelphia, Pa.

*Vice Pres.*—Carl N. Brown, Asst. Gen. Sales Mgr., U.S. Pipe and Foundry Co., Burlington, N.J.

*Treasurer*—Hubert F. O'Brien, Pres., A. P. Smith, Co.

*Manager*—John G. Stewart, New York City.

3. Inquire first and attack afterward

4. Be sure the buyer understands that you understand his objections

5. Stick to one key issue

And the speaker added one more rule—Ask "Why" It will save many other words

### Inspection Trip

Miami's Hialeah Water Plant was the object of the inspection trip. Many of the convention attendees made the trip by bus or car to see this modern plant with its outdoor filters, its softening equipment and especially its lime kiln and lime recovery process. The construction problems, the prevention of salt water intrusion in the well supply, the meeting of an ever growing demand and the operation of the plants since obtained by the city in 1941 make a fascinating story as told in the brochure, "Water for the Magic City." One of the most interesting parts of the visit to the plant was the inspection of the rotary pebble lime kiln for the production of reclaimed lime from the waste lime sludge from water softening.

During the first year of operation, the lime recovery plant produced 17,507 tons of lime, of which 14,848 tons were used in the Hialeah plant and 2,659 tons sold to Ft. Lauderdale and Daytona Beach with a saving in operation cost of the water plant of $168,000. The water plant has pumped up to 71 mgd. and has reached capacity; a new 40 mgd. plant is now being built.

### Session Attendance

While the size of the registration, the number of exhibitors, and the number of booths in the exhibition hall, all go to make a good convention, it is the actual attendance at the technical sessions which is a measure of a meeting of this kind. In spite of the fact that the exhibition hall and the technical meeting rooms were five miles from the hotels and transportation was not too satisfactory, technical session attendance was good. Many persons attending the convention came by car and few of those left their hotels without a load; others took taxicabs, and still others braved the forty minute bus ride.

Naturally, the General Sessions drew the largest crowds with the attendance reaching 275 at one of these meetings, and the session on National Water Policy at which Sam Morris and Abel Wolman spoke drew 255. One of the Water Resources Division meetings drew 225 persons and one Water Works Management Session drew 235 persons. The Water Purification Division which has always drawn large numbers of attendees, this year found less than 200 at its largest meeting, but one session in which fluoridation was the topic held almost that many persons until after 6 p.m. Smallest attendance was chalked up by the open sessions of the Water Works Practice Committee and the Water Works Administration Committee, but this might well be expected since these sessions opened the convention on Monday morning, while the registration was still developing. The holding of these two sessions simultaneously probably cut the attendance at both.

Next year the convention will be held in Kansas City, Mo. during the week of May 4, and the following year the convention will be in Grand Rapids, Mich.

*Geo. Ferguson*
*Staff Officer*
*USGS*
*Washington, D.C.*
*(Chairman)*

*Dale Moffitt*
*Gen. Mgr.*
*Water Dept.*
*Des Moines, Iowa*
*(Vice Chairman)*

**Officers of Water Resources Division**

*F. W. Kittrell*
*Chief*
*Str. San. Sect. TVA*
*Knoxville, Tenn.*
*(Sec'y-Treas.)*

*Fred Merryfield*
*Prof. San. Engr.*
*Univ. of Oregon*
*Corvallis, Ore.*
*(Director)*

*L. E. Goit*
*Supt.*
*Water Dept.*
*Los Angeles, Cal.*
*(Director)*

## Water Works Management Comm.

Under the Chairmanship of WENDELL R. LADUE, Chief Engineer and Superintendent, Bureau of Water and Sewerage, Akron, Ohio, the Water Works Administration Committee held an open session. Mr. LaDue, opened the session by reviewing the list of 18 sub-committees and the four task groups which are at work under this committee. It was impossible to have a report from all of the subcommittees and the Chairman confined the discussions to those of greatest immediate interest and importance. Some of the work of the task groups overlap the work of similar groups in the Water Works Practice Committee but the efforts of the two groups are complimentary rather than duplicative.

The importance of the various interests of the several sub-committees of the Water Works Administration Committee is evidenced by the fact that at last year's convention in Philadelphia, 13 of the papers presented were devoted to subjects under the auspices of this general committee. The meeting this year in Miami was similar in the proportions of the papers presented.

While "Safety" has not been assigned to a sub-committee, nevertheless there has been a task group under the leadership of Ray Faust, at work on the topic. Mr. Faust reported that he believed that it would be helpful and worthwhile to have a subcommittee and that it would also be worthwhile to join the National Safety Council. There is no program for safety in water works in the Nat. Safety Council, but no doubt one would be developed if the AWWA should join the Council and aid in the development of such a program.

One of the most important phases of a safety program is to learn the Frequency Rate and the Severity Rate of accidents in water works. Based on data submitted by 33 cities which do belong to the Nat. Safety Council, the frequency rate for water works is 33.0 compared to approximately 10 for all other industries. The severity rate for these water works, however, was 0.90 as compared with a severity rate of 1.02 for all industries.

Discussion from the floor brought from L. R. FINCH, Vice Pres., Indianapolis Water Co. the admission that

their frequency rate was higher than the national average but like other cities, the severity rate was lower. PAUL WEIR, Gen. Mgr., Atlanta Water Dept., said that most accidents occur in the distribution system crews. Atlanta is self insured but doesn't expect to be able to remain in that position.

LEONARD THOMPSON, Gen. Mgr., St. Paul, Minn., Water Dept., asked if water companies could obtain insurance from a private company to protect workers engaged on distribution system work brought about by State Highway jobs.

ARTHUR KURANZ, Supt. of Water Utility, Waukesha, Wis. reported that his utility obtained private company insurance, rotating it among several companies and that it covered public work as well as private. Rates have been dropping each year as a good experience record has been built up. Workmen's compensation is also carried with private companies and the overall coverage amounts to less than one per cent of the total payroll.

EARL E. NORMAN, Mgr., City Light and Water Utilities, Kalamazoo, Mich., reported that his utility also obtained private insurance and he suggested that water utilities obtain movies on safety from the Nat. Safety Council.

SAMUEL B. MORRIS. Gen. Mgr., Los Angeles Water and Power Dept. injected a word of warning; where workmen's compensation is available, the accident frequency rate has been found to increase, particularly where compensation is available in addition to regular salary.

At the close of the discussion of this particular topic, the assembled group voted that a safety program by the AWWA should be pursued.

### Radio and Mobile Equipment

M. B. CUNNINGHAM, Supt. and Engr., Water Dept., Oklahoma City, Okla., who was scheduled to speak on the subject at the Friday morning session, also spoke briefly at this open session of the committee. Mr. Cunningham echoed the suggestion of Mr. LaDue, that if a municipality or utility contemplated the use of radio and mobile equipment, it should not delay in ordering the equipment.

Mr. Cunningham also suggested that a water utility should cooperate with the civil defense organization in its community, BUT the water works should not turn its radio facilities over to the civil defense organization. The water works facility is so important a part of civil defense in event of a catastrophe that it will find need for the complete capacity of its radio system.

R. W. MORSE, Supt. Water Dept., Seattle, Wash. said his utility used a code system in order to save air time for the city light department, but PAUL WEIR of Atlanta said his department found it couldn't operate with a code. Mr. Weir investigated the Bell Telephone System which operates through the regular radio-telephone hook-up, and then decided on an independent FM radio of General Electric manufacture. Mr. Norman of Kalamazoo also said that he rejected the Bell system because there was too much dependence on the "other fellow" and L. R. FINCH of Indianapolis said that interference by other persons using the "party" line delayed transmission of messages to mobile units. Also, the use of profanity by the men operating the mobile units had almost caused the emergency conversation to be cut off. This might be an important factor in an extreme emergency.

### Main Extension Policy

LOUIS R. FINCH, Vice Pres. and Chief Engr., Indianapolis Water Co., Indianapolis, Ind., spoke as the chairman of the sub-committee on water main extension policy. No report was planned for this meeting, but one will be issued next year. During the ensuing year the committee proposes to study the matter of free extensions, suburban areas, state requirements, and a yardstick for rates.

Mr. LaDue pointed out that the growth of suburban areas in comparison with the growth of cities made it evident that this problem of main extensions was here to stay. In Akron, during the last ten years the suburbs gained 45 per cent in population while the incorporated city area gained only 15 per cent.

On the matter of how to charge consumers in these outlying districts, DALE MAFFITT, Gen. Mgr., Water Dept., Des Moines, Iowa explained the formation of "beneficial water districts" which could be set up legally and obtain water from a going utility at a rate 50 per cent higher than the incorporated district. CHAS. MOORE, Gen. Mgr., Roanoke, Va., wanted to know how the 50 per cent higher rate was justified. Mr. Maffitt replied that the corporate city residents carry the obligation of the bonds and therefore the "outsiders are willing to pay the higher rates." M. P. HATCHER, Director of Water, Kansas City, Mo., said the people outside the corporate limits are not entitled to the advantages of ownership. Furthermore, they should pay on the basis of a return that would be required by a private company. In his utility, several rates exist for outside areas. LEONARD THOMPSON of St. Paul, Minn. expressed the opinion that in most cases the old system was paid for, and much of those old facilities were essential to provide service to outlying areas. Therefore, it should not be presented to these districts on a silver platter with charges only for main extensions and with water furnished at regular rates; higher rates are justifiable. E. E. NORMAN of Kalamazoo reported that in Michigan it was possible for a township to obtain a franchise for water purveying and that the supply could be taken from the incorporated village or city. Thus it is possible to have but one system instead of several small water supplies. This came as a result of the practice of charging much higher rates outside of the city. Now the outside rate is 25 per cent above that for the incorporated municipality.

Rates for other areas varied from 100 per cent surcharge in Durham, N.C. down to 5 per cent in Detroit, Mich.; while Houston is another city that has a 50 per cent higher rate. The extreme interest in this subject led the assembled group to vote to have a paper presented on this topic at the meeting next year in Kansas City, Mo.

**Officers of Water Purification Division**

*H. O. Hartung*
*Asst. Gen. Mgr.*
*St. Louis Co. Wat.*
*St. Louis, Mo.*
*(Chairman)*

*Ray L. Derby*
*San. Engr.*
*Wat. & Pow. Dept.*
*Los Angeles, Calif.*
*(Vice Chairman)*

*M. E. Flentje*
*Res. Engr.*
*Am. Wat. Wks. Serv.*
*Philadelphia, Pa.*
*(Sec'y-Treas.)*

*W. W. Aultman*
*Purif. Engr.*
*So. Cal. Wat. Dist.*
*La Verne, Cal.*
*(Director)*

# Critical Materials—Priorities—Allocations

The program had scheduled a general session on Friday morning during which the subject of critical materials and allocations were to be discussed but during the whole week the atmosphere of the meeting was filled with comment and apprehension on the subject. The AWWA Secretary's office and representatives of the manufacturers were working toward the fulfillment of a desire to have a strong claimant agency established in Washington for the water works industry and sewage works. Harry Jordan, Secy. of AWWA requested all water works managers to send telegrams to their respective senators and representatives in Washington asking that the problem be brought forcefully to the attention of the National Production Authority and the Defense Production Administration. The Board of Directors of the AWWA passed the following resolution and sent it to the authorities concerned with the matter:

"The American Water Works Association represents water facilities serving 90 million persons and a major segment of industry in the United States. Neither human life nor industrial activity can continue without an ample and usable water supply.

"This essential utility cannot deliver such water without the reasonable availability of materials and supplies for day to day operation, maintenance and repair, and for required plant expansion and system extensions.

"During the present emergency such materials and supplies are not in a free market and accordingly are not readily available without effective priority and allocation assistance. Such assistance can only be provided through the formation of a strong claimant agency within the Defense Production Administration.

"Six months of active effort by a committee representing the Association has been unable to achieve the formation of an effective claimant agency.

"Therefore, the Board of Directors of this Association again forcefully calls to the attention of all appropriate governmental officials the critical nature of the present situation and asks for immediate relief to preclude the possibility of a nationwide water supply crisis."

*L. R. Finch*
*V. P. & Ch. Engr.*
*Ind. Wat. Co.*
*Indianapolis, Ind.*

*Lew. Thompson*
*Gen. Mgr.*
*Water Dept.*
*St. Paul, Minn.*

*Art Kurasz*
*Mgr.*
*Water Util.*
*Waukesha, Wis.*

*M. P. Hatcher*
*Director*
*Water Dept.*
*Kansas City, Mo.*

**Water Works Administration Committee Session**

At the annual meeting of the WSWMA, W. J. ORCHARD, Gen. Mgr., Wallace & Tierman, reported that telephone communication with Messrs. Flieschman and Wampler, respective heads of the NPA and DPA had assured him that such a claimant agency would be formed and a meeting was scheduled for May 8 to develop the agency and determine the staff required. Mr. Orchard reported further on the subject at the Friday morning session of the convention.

It was at that Friday morning session chairmanned by WENDELL R. LADUE, Ch. Engr. and Gen. Mgr., Bur. Water and Sewerage, Akron, Ohio, that the whole subject of critical materials, priorities, and allocations was taken up.

### Why A Claimant Agency

HARVEY S. HOWE, Asst. Vice Pres., Lock Joint Pipe Co., E. Orange, N.J., has been working with a committee of manufacturers on the subject and has spent considerable time in Washington. In answer to the question, "Why

LATE NEWS: As of May 8, a Claimant Agency for Domestic and Industrial Water and Domestic and Industrial Waste was assured by Manley Flieschman, Head of the National Production Authority. This information was conveyed to Harvey Howe, representing the Water & Sewage Works Manufacturers Assn.; W. J. Orchard, representing the Federation of Sewage & Industrial Wastes Assns.; Harry E. Jordan, representing the American Water Works Assn.; and Abel Wolman, representing the American Public Health Assn.

According to information from Mr. Howe, at that meeting in Washington on May 8, Mr. Flieschman committed himself to taking specific action on the formation of the Claimant Agency during the week of May 14.

These four persons representing the four associations named, assured Mr. Flieschman of the unified interests of the four organizations and the industrial field they represent. Messrs. Howe, Jordan, Orchard, and Wolman specifically requested that the agency should be of independent nature at the proper level to have appeal direct to the NPA. Mr. Flieschman stated that he had too many Bureaus now and would therefore only agree that the Claimant Agency be set up at industry level within an existing bureau. At that time he had made no decision as to the choice of bureau.

At that conference, Mr. Flieschman asked for an organization chart and suggestions as to personnel for the Claimant Agency. That information was delivered to him on May 10. He pointed out that once the head of the agency was appointed, it would be the task of that head to staff the organization and put it in operation.

Mr. Howe advises, that as it now stands, under the Controlled Materials Plan (CMP), which goes into effect on July 1, there is NO provision made for the water, sewage, and industrial waste industry, and that it will have to scramble in the open market for its materials for the third quarter of this year. If the new Claimant Agency is set up and proceeds immediately to develop the requirements for domestic and industrial water and waste, it is possible that allotments under CMP may be available for the fourth quarter. Mr. Howe has emphasized the need for all persons concerned with the management of water works, sewage works, or industrial water or waste treatment plants to cooperate to the fullest extent in making their requirements known to the Claimant Agency as soon as it is formed.

do we need a claimant agency for Domestic and Industrial Water and for Domestic and Industrial Waste," Mr. Howe pointed out that there is not only a great common interest, but also, much common equipment.

As to what is a claimant agency, Mr. Howe said it is an organization which determines the needs of an industry, gives that information to the DPA and obtains an allocation of materials for that industry. The first thing Washington needs to know is the requirements of water. Mr. Howe reviewed the history of the committee, which was of an informal nature, and the report on the needs of water, sewage and industrial waste. That information was given to General Harrison, but no results were obtained.

For an answer to a question to "How the allocation of materials is being handled now," Mr. La Due called on WALTER L. PICTON, formerly Water and Sewage Works Expert with the National Security Resources Board and now with the Defense Production Administration. Mr. Picton pointed out that the DPA is equivalent to the top structure of the old WPB of World War II and is a subsidiary of NPA. It has jurisdiction over most manufacturers.

Mr. Picton then explained how a section of DPA determines a program for and requirements of industries for a certain number of months. These are then analyzed by another section of DPA and put in balance with other programs. These requirements go to a Requirement Committee and are adjusted. On July 1, CMP (Controlled Materials Plan) will go into effect. This is really a plan for partial allotment of materials for certain industries. Some industries won't receive allotments. Mr. Picton, at present doubts that the water works industry will receive any definite allotments and will probably have to buy on the open market. Such industries as are hardest hit may appeal on the basis of a hardship case.

Mr. Picton emphasized that the water works industry is one of the most important when it is known that with a $50 billion inventory, a $1 billion annual operating cost and a need for more than one million tons a year of metal products for operation and two million tons a year for needed expansion. If defense production is to expand, then water works facilities must also expand. It is necessary therefore that the Water and Waste Industry, both domestic and industrial, must have a strong claimant agency in Washington.

For an answer to the question "What has been done up to now to establish a claimant agency," Mr. La Due called on W. J. ORCHARD, Gen. Manager, Wallace & Tiernan and active in the affairs of the Water & Sewage Works Mfrs. Assn. According to Mr. Orchard, the problem goes back to the assumption by Mr. Truman when war began in Korea, that defense production would need no separate organization and that regular federal agencies could handle all of the work involved. Under this assumption, water facilities and supply problems were assigned to the Housing and Home Finance Bureau (Sewage was not assigned anywhere). This mistaken assumption and its consequent results caused the development of the belief that there was no problem in water supply and would be none. To some extent manufacturers aided with this wrong assumption by dipping into inventory which they could ill afford to do.

In December, a committee was assembled and on January 17 this committee of twenty persons representing the AWWA, the APHA, the FS& IWA, and the WSWMA met with General Harrison. To all intents and purposes no action was forthcoming in Washington as a result of that meeting. Then began a tug of war between other agencies for jurisdiction. This only resulted in more confusion. As a result of many wires from Miami, conferences, and telephone calls, and persistence on the part of Mr. Orchard and those working with him, a commitment was made to Mr. Orchard on Tuesday of the Convention week and reiterated on Wednesday by Messrs. Wampler and Flieschman of the NPA and DPA to the effect that a claimant agency for the water and waste field would be set up. As of that time, no decision had been made as to where to place the agency. A meeting was scheduled for May 10 in Washington at which time the matter was to be decided. When that office is set up it will have to be staffed with perhaps two dozen persons, the top personnel of which must come from the industry. Salaries probably will range from $5800 to $9500.

**Critical Materials, Priorities, Allocations**

*Walt. Picton*
*Wat. & Sew. Exp.*
*DPA*
*Washington, D.C.*

*W. J. Orchard*
*Gen. Mgr.*
*Wallace & Tiernan*
*Newark, N.J.*

*H. B. Shaw*
*Supt.*
*Wash. Sub. San. Dist.*
*Hyattsville, Md.*

*Tom Skinker*
*Wat. Comm.*
*St. Louis*
*Mo.*

In discussing this problem from the point of view of a water superintendent, HARRY B. SHAW, Supt. of the Washington Suburban Sanitary District explained how much confusion was existing at present. One man assigned to the task of obtaining information on how to order and obtain materials spent nearly two months and arrived at no solution. Although much of the increase in population resulting from the defense program in Washington will reside in his district, even Mr. Shaw can not obtain the materials he needs.

TOM SKINKER, Water Commissioner, St. Louis, Mo. reported that he had obtained excellent cooperation from the Dept. of Commerce representatives in his area, but this cooperation had only been in the obtaining of promises that his needs and orders would be fulfilled. Delivery dates for much of the steel which St. Louis needs have been set for late May and June. Mr. Skinker is hopeful, but had no idea as to whether or not the material would actually be delivered as promised.

MAX K. SOCHA, Engr. of Water Dist., Los Angeles, Calif. reported that to alleviate the hardship caused by the copper order, his department was experimenting with "Tennite" plastic tubing for copper substitute in water services. Except for the fact that the plastic will not stand temperatures above 140 deg. F., it appears to have excellent possibilities. It will withstand pressures up to 800 psi.; jointing is simple; it can be swedged, and it can be formed to any contour desired, when warmed in hot water. Los Angeles intends to use it wherever possible and may make it standard practice. Mr. Socha cited the experience to point up the fact that water works men must again look to substitute materials.

(A second installment on the report of the Miami Convention and the technical papers will appear in the next issue.)

Demonstration of faucet flaming with "Prepo" Torch by E. H. Hempel, Chemist, Austin Water Treatment Plant.

# New Idea in Blow-Torches

*Proves Highly Satisfactory Flaming Device for Faucet and Hydrant Sterilization*

*A Contribution of*

A. H. ULLRICH, *Supt., Water & Sewage Treatment, Austin, Tex.*

EVER since we have been required to collect and test large numbers of water samples from the distribution system, I have tried to find a quick, safe, and easy method for sterilizing faucets or hydrants.

Between the years of 1940 and 1950, I have bought and tried nearly every type of gasoline burner or torch advertised by the standard laboratory equipment houses. None were really satisfactory for our purpose. About 1945, I had a machine shop in Fort Smith build us a special one-quart capacity cylinder suitable for filling with liquid butane and equipped with a needle valve and bunsen burner connection. A bunsen burner was connected to the cylinder with hose, and this assembly was used experimentally. While it was too heavy and cumbersome for satisfactory use, it did work well and we felt that if we could find a manufacturer willing to produce small, light weight pressure cannisters we would be able to develop the ideal portable torch.

It was, therefore, with mixed emotions that I saw and read in the August, 1950, issue of *Water & Sewage Works* (Equipment News Section), and also in *Fortune* magazine, a brief illustrated description of a new type of small blow-torch called "Prepo," which appeared to be the answer to my search.

I wrote the manufacturers, Pressure Products Corp., 140 N. Dearborn St., Chicago, Ill., requesting this firm to supply one complete torch, consisting of the torch head and one container (cannister) of fuel. I was referred to a local dealer, from whom we purchased one complete unit for trial at a cost of $7.95—the torch head being $6.95 and pressure container of fuel $1.00. (These throwaway cannisters of fuel are less if purchased in boxes of six containers.)

Our chemist, E. H. Hempel, here pictured using the "Prepo" Torch, has used this unit considerably and reports that it is handy, clean, and otherwise satisfactory as a portable torch for sterilization of faucets. He reports that with the single cannister of fuel he was able to sterilize a total of forty hydrants and faucets.

It now appears to us that the "Prepo" torch, with its throw-away fuel containers, is the answer to the water sample collector's prayer if we can arrange to buy the cans (fuel containers) in case lots directly from the manufacturer, instead of through dealers at the retail prices. Since the larger cities collect quite large numbers of samples, they would likely be volume purchasers and should be able to buy direct as they do from other manufacturers. I am now attempting to get Pressure Products Corp. of Chicago to supply case lots of the fuel containers, rather than have to pay the retail price.

I do not know how well this torch will stand up, nor do I know to what extent its availability is known to water and sewage works men, but I think it should be made known to your readers.

[Ed. Note: For the benefit of our readers we are reprinting the description of the handy little "Prepo" Torch from our August, 1950, issue to which Mr. Ullrich refers.]

### Prepo Torch and Fuel

Pressure Products Corp., Chicago, Ill., has introduced a self-pressurizing fuel for flame tools and small appliances, packaged in a seamless throwaway container much the same in size as an ordinary beer can.

The new fuel is called "Prepo" and is designed to be used with the "Prepo" hand torch, which lights instantly, without pouring, pumping or priming and burns with a clean, blue flame of more than 2200 degrees.

An unusual feature of "Prepo" is that, like "bottled gas" it cannot be poured from the container, for there is no way the container can be opened. A rubber valve mounted on top of the container permits it to be attached to a mating fixture on the torch or other appliance. The seamless steel pressure container of fuel becomes the fuel tank of the appliance until empty, when it is quickly removed, thrown away and replaced by a new one.

The accompanying picture shows the Standard Torch Head on left and Pinpoint Soldering Head on right.

"Prepo" Torches.

Little Rock's 16 mgd. Filter Plant

# Chlorination Maintains Supply Line Capacity

*Twelve Year Record of Little Rock Experience*

*by* L. A. JACKSON, *Manager and* W. A. MAYHAN, *Chemist, Little Rock Municipal Water Works, Little Rock, Ark.*

EIGHT years ago the authors first told the story of the efforts to maintain the design capacity of a 33-mile, 39-inch transmission line on the Little Rock Water Supply.

That article appeared in the April 1943 issue of *Water & Sewage Works*. It was titled "Chlorine—A Critical Material Solves a Critical Problem" and it told "the story of a three year battle to re-establish the design capacity of a vital supply line."

Now the authors have had nine more years experience and a twelve year battle on which to report. For the benefit of those readers who did not see the original story, there is repeated herewith some of the basic information on the construction of the line and the source of supply.

### Construction Data

In 1936 construction of a new source of water supply for the City of Little Rock, Arkansas, was begun. This included the construction of a rolled earthen dam across the Alum Fork River, impounding a lake of 14 billion gallons of water at a point approximately 33 miles west of Little Rock. This distant new source of supply was connected to the Purification Plant, located in Little Rock proper, by a 39-inch internal diameter, steel-cylinder, reinforced concrete pipe line.

Each pipe section was 16 feet long and weighed 4¼ to 4½ tons. The pipe consisted of a welded steel cylinder with galvanized steel joint rings welded to its ends, a concrete lining approximately 1⅛ inches thick, and a concrete covering reinforced with a cage of spirally wound steel rods. The total wall thickness is approximately 4 inches. The joint was of the B&S type with a round rubber gasket, located in a groove on the spigot section.

The spill elevation of Lake Winona, the new source of supply, is 230 feet above the receiving basin elevation at the Filtration Plant in Little Rock, and the flow from the reservoir to the plant is wholly by gravity. At the time of construction no provision was made for sterilizing treatment at the lake end of the line. None was conceived as being justified at the time, for pollution was no problem and subsequent problems had not been foreseen.

### "C" Value of 147 25.32 MGD. Capacity

In February, 1938, all construction work was completed.

The lake, having filled to overflowing in December of the preceding year, the new mountain supply was turned into the system. The designed capacity of the 39-inch raw water flow line was 25 m.g.d. In April, 1938, two months after the pipe line was put into service, it was tested to determine its actual maximum carrying capacity. This test revealed that the line would actually deliver 25.32 m.g.d., and that Hazen-Williams coefficient "C" for the entire line was 147.

No further tests were made on the line's carrying capacity until a year later (Feb. 23, 1939). A few months before this second test it had been noted that on opening the line wide, it did not deliver 25.32 m.g.d., but that the capacity was gradually dropping, and at the time of the second test,

maximum delivery was only 20.38 m.g.d. and the average "C" for the entire line was found to have dropped to 120. Thus in the brief period of one year's operation the carrying capacity of the line was reduced 20 per cent. With the fear that we might wake up some morning and not be able to get enough flow through the line for our requirements, something had to be done quickly.

A portion of the line, near the reservoir, was immediately dewatered and inspected. It was found that the interior of the pipe was covered with a very dark, almost black, organic slime deposit or growth, which varied from a very thin film in some places to a heavy mat of more than ¼ inch thickness in others. The growth was rather heavily interspersed with iron oxide and appeared to have a jelly-like consistency, being easily removed by drawing bare fingers over it. (See Table I for analysis of Lake Winona water.)

Samples of this deposit or growth were collected and numerous tests were made on it, both chemical and bacteriological, in the purification plant laboratory. Samples were also sent to the laboratory of Wallace & Tiernan Co. in Newark, N. J., where they were examined by Mrs. E. S. Horning of that firm. It was found that three types of organisms predominated, namely, large, gram plus, encapsulated bacteria; a smaller form of gram plus encapsulated bacteria, and the iron bacterium, Crenothrix. Photomicrographs of these various organisms were made and are shown in Fig. 1.

Table 1
RAW WATER ANALYSIS—LITTLE ROCK, ARK.
*Lake Winona*

| Component | p.p.m. |
|---|---|
| Silica ($SiO_2$) | 5.60 |
| Iron and Aluminum Oxides ($Fe_2O_3$ and $Al_2O_3$) | 0.43 |
| Calcium (Ca) | 3.77 |
| Magnesium (Mg) | 1.26 |
| Sodium and Potassium (Na K as NA) | 3.04 |
| Bicarbonate ($HCO_3$) | 14.64 |
| Carbonate ($CO_3$) | 0 |
| Sulphate ($SO_4$) | 2.07 |
| Chloride (Cl) | 5.00 |
| Carbonate Hardness | 15.00 |
| Total Hardness | 15.00 |
| Total Dissolved Solids | 26.00 |

### Ammonia-Chlorine Treatment

The problem of removing this organic growth from the line was given very careful study. It was finally decided that the application of chlorine and ammonia at the head of the supply line presented the best available approach to the solution of this problem. Immediate steps were taken to provide treatment facilities at the lake. Due to the physical construction it was decided to install the treatment plant about 1,300 feet from the intake tower in the lake, utilizing in part a control valve house structure, located at this point. Facilities for the application of chlorine and ammonia were purchased and installed at a total cost of $15,000. No provision was made for treating the first 1,300 feet of line between the intake tower and the control valve house. This short stretch of line was of tunnel construction and we felt that periodic treatment of this short section would keep it clean.

The ammonia-chlorine treatment was begun on June 2, 1939, at a treatment rate of 1.26 ppm. of chlorine. and one-third as much ammonia. At the end of the first three weeks of treatment, the capacity of the line, as measured by the Venturi meter, had increased from 20.38 m.g.d. to 21.80 m.g.d., but no "C" determinations were, as yet, made on the line. During this 3 weeks' period the residual chlorine reaching the 33 mile distant Filtration Plant in the city remained fairly constant at 0.55 p.p.m.

Prior to starting the ammonia-chlorine treatment, the "C" value of the line had been determined twice, on February 23, 1939, and again on May 25, 1939. These determinations were carried out empirically, dividing the entire line into seven sections and determining the "C" value of each section. From these results the average "C" value for the entire line was then computed.

During the next 30 day period (July 1-31, 1939) the 1.3 ratio of ammonia to chlorine was changed to 1:6 without changing the chlorine dosage. This did not affect the residual reaching the Filtration Plant, which remained at 0.55 ppm., but any further reduction in ammonia did result in a lower residual reaching the plant.

On July 31, 1939, friction coefficient determinations were made on the entire line under full flow conditions, and the "C" values for some sections showed noticeable improvement, the results being best nearest the point of chlorine application. The results of this and subsequent tests are shown in Table II.

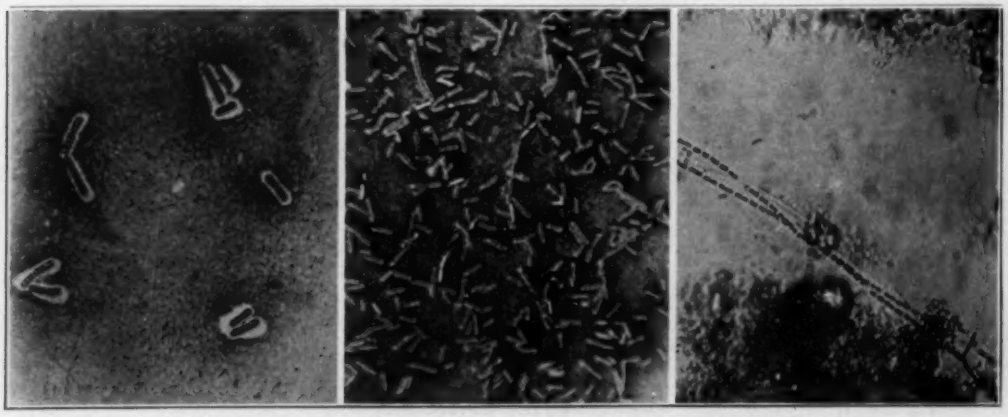

**Fig. 1—Photomicrographs of Organisms Found in Flow Impeding Slime on Pipe Walls**
*(Left and center: Large and small gram plus capsulated bacteria; Right: Crenothrix)*

33-Mile, 39-Inch Transmission Line Under Construction

### Copper Sulphate Treatment

At about this time (Aug. 1, 1939) a test on the 1,300 feet of line between Intake Tower and Control Valve House showed a "C" value of only 84. Since this section of line was not being treated with chlorine, the entire supply line was taken out of service, this section isolated, and treated heavily with copper sulphate and allowed to stand 48 hours in contact with the copper solution. [Here it is well to explain that an auxiliary reservoir floats on the supply line near the city, thus permitting holding the supply line out of service for considerable periods when necessary.] At the end of this time, the copper solution was thoroughly flushed out and the line put back in service, with the ammonia-chlorine treatment again being resumed. Subsequent tests on this section of the line showed no improvement due to the copper treatment.

Full flow tests were again made on the line on Aug. 11, 1939, and these indicated still further improvement in "C" values. At this time the chlorine dosage was increased to 1.60 p.p.m., with ammonia at 1:4 ratio.

On Aug. 14, 1939, strong chlorinous odors developed at the filtration plant. The chlorine dosage was immediately reduced to 1.0 p.p.m. and the ammonia ratio raised to 1:3. The chlorinous odors gradually disappeared over a period of 2-3 weeks.

On Oct. 2, 1939, the 1,300-foot Intake Tower-to-Control Valve House section of line was again isolated and this time treated with 30 p.p.m. of chlorine for a period of 48 hours. At the end of this time the line was flushed and the original ammonia chlorine treatment resumed.

### Free Residual Chlorination

On April 3, 1940, a full flow test was made on the entire line. The maximum capacity was found to have increased from 21.80 to 22.25 m.g.d. "C" tests on the 1,300-foot Intake Tower section showed great improvement. The "C" value for this section had been raised from 77 to 159. This indicated that straight chlorine treatment, in heavy concentration, should be highly effective in killing and dislodging the organic growth. It was, therefore, decided to discontinue the use of ammonia at the reservoir and to raise the chlorine dosage to "break-point" proportions, free residual chlorination. Laboratory tests had indicated the "break-point" of the raw lake water to be 3.5 ppm.

Free Residual chlorination was begun on Aug. 5, 1940, using a chlorine dosage of 5.0 ppm. The residual reaching the filtration plant was, on the average, 1.0 ppm., the remaining 4.0 ppm. being dissipated in the line. At this time, tests were made at various points on the line to determine the chlorine residual present. The results of these and subsequent tests are shown in Fig. 2.

Ammonia was still used in the purification processes, being applied to the already super-chlorinated water at the Filtration Plant at a 1:3 ratio, this ratio being based on the chlorine residual in the water arriving at the plant.

On Sept. 27, 1940, the chlorine dosage was reduced to 4.0 p.p.m., this reduction being occasioned by lower water temperatures and a lowered "break-point." ["Break-point" determinations were made at various times during each year and have varied from a high of 3.5 ppm. in the sum-

One Ton Chlorine Containers Required for Continuous Chlorination
*(Note difference between this and intermittent chlorination arrangement)*

mer to a low of 1.5 ppm. in the winter.]

### Super-Super Chlorination

Since the removal of the organic growth from the line was proceeding much slower than anticipated, at two different intervals during 1941 exceedingly heavy chlorine concentrations were employed for periods of 24 hours each. On these occasions, flow was reduced and the treatment rate was stepped up to 300-400 ppm., the heavily treated water being wasted into a creek near the Little Rock end of the line. The method used was to connect a battery of 4 one-ton chlorine containers into a large rubber hose manifold, which, in turn, was inserted into the pipe line through a pressure manhole near the reservoir. The flow through the line was kept at 10 mgd. during the time of treatment. At the end of the treatment the line was thoroughly flushed, put back into service and the original "break-point" treatment resumed.

On Oct. 21, 1940, a full-flow test was made on the line, the results of which indicated still further improvement in "C" values and maximum carrying capacity recorded since the beginning of the chlorine treatment.

On Oct. 27, 1940, the chlorine dosage was still further reduced to 3.0 p.p.m., and with few exceptions this treatment rate remained unchanged until Sept. 12, 1941, almost a year later. At this time it was increased to 3.5 ppm., where it remained until the end of 1941.

During the year 1941, four more full-flow tests were made on the line, each indicating still further slight increases in carrying capacity.

**Intermittent Chlorination in Intake Tower**

*(Liquid chlorine from inverted chlorine cylinder is applied through tube and down-pipe. Dosage is controlled manually by an auxiliary valve on cylinder)*

Table 2

HAZEN-WILLIAMS COEFFICIENT "C" DETERMINATION—
39" RAW WATER SUPPLY LINE

Original "C" When Installed = 147. for Entire Line
Original Maximum Flow = 25.32 M.G.D.

| Date | Intake Tower to Control House | Box 226 | Box 198 | Box 141 | Box 71 | Box 42 | Box 15 (Junction) | Average "C" Entire Line | Maximum Flow in M.G.D. |
|---|---|---|---|---|---|---|---|---|---|
| 2-23-39 | ..... | ..... | 98 | 113 | 121 | 137 | 131 | 120 | 20.38 |
| 6- 2-39 | Chloramine Treatment Started—1.0 p.p.m. Chlorine plus 0.33 p.p.m. Ammonia | | | | | | | | |
| 7- 1-39 | 84 | 128 | 110 | 122 | 133 | ..... | 133 | 128 | 21.80 |
| 10- 2-39 | Treated Intake Tower—Control House Line Section with 30 p.p.m. Chlorine (from Oct. 2-5th) | | | | | | | | |
| 8- 5-40 | 144 | 117 | 117 | 129 | 127 | 133 | 139 | 128 | 22.20 |
| 8- 5-40 | Ammonia discontinued—Super Chlorination begun. Treatment rate 5.0 p.p.m. | | | | | | | | |
| 6- 5-41 | 116 | 121 | 120 | 130 | 134 | 135 | 141 | 132 | 22.80 |
| 6-21-41 | Treated entire 39" Line from Control House to Box 15 with 100 p.p.m. dosage of Chlorine (12 hr. contact) | | | | | | | | |
| 10- 1-41 | 128 | 124 | 127 | 135 | 134 | 137 | 143 | 136 | 22.89 |
| 10-18-41 | Treated entire 39" line from Control House to Box 15 with 100 p.p.m. dosage of Chlorine (12 hr. contact) | | | | | | | | |
| 11-12-42 | 108.6 | 130.3 | 128.1 | 138.6 | 133.7 | 139.1 | 144.5 | 137.0 | 23.50 |
| 3- 5-43 | 105.67 | 123.72 | 128.08 | 142.96 | 136.00 | 138.91 | 145.87 | 138.43 | 23.94 |
| 2- 4-44 | 103.36 | 124.38 | 121.43 | 138.03 | 135.74 | 147.55 | 148.80 | 138.69 | 23.42 |
| 2- 8-45 | 81.45 | 120.58 | 117.86 | 135.24 | 132.53 | 149.35 | 148.62 | 137.07 | 23.33 |
| 2-14-46 | 116.83 | 127.78 | 121.96 | 135.53 | 133.47 | 156.10 | 156.89 | 141.48 | 24.08 |
| 4- 8-47 | 95.69 | 128.88 | 123.28 | 130.91 | ..... | 138.21 | 140.07 | 134.39 | 22.98 |
| 3-17-48 | 83.40 | 129.56 | 123.16 | 133.25 | 136.56 | 140.77 | 142.05 | 135.42 | 23.20 |
| 12-16-49 | 76.80 | 125.44 | 122.70 | 127.96 | 125.97 | 142.11 | 148.16 | 131.28 | 22.47 |
| 12-20-49 | Discontinued Breakpoint Chlorination—Started New Intermittent Chlorination Treatment (12 p.p.m. for 1 hr. each week) | | | | | | | | |
| 4-20-50 | 78.71 | 124.18 | 124.64 | 129.60 | 132.46 | 140.47 | 138.56 | 132.74 | 22.75 |
| 8- 1-50 | 84.50 | 127.48 | 124.64 | 127.49 | 133.27 | 142.44 | 137.32 | 132.84 | 22.75 |

Flow tests, made on the line after these two superchlorination treatments, did not show any very great improvement, due to this type of treatment over and above the "break-point" dosage scheme.

Throughout the year of 1942 two full-flow tests on the line were made, the results still showing very slow improvement in maximum line capacity.

The "break-point" chlorination treatment was carried on through the years until December 1949. Treatment dosages employed were essentially those of former years; the chlorinse dosage being kept approximately 1.0 ppm. higher than that required to reach the "break-point." Periodic determinations of the friction coefficient "C" indicated that the treatment was satisfactory.

In the latter part of 1949, a very careful study of the results of the ten

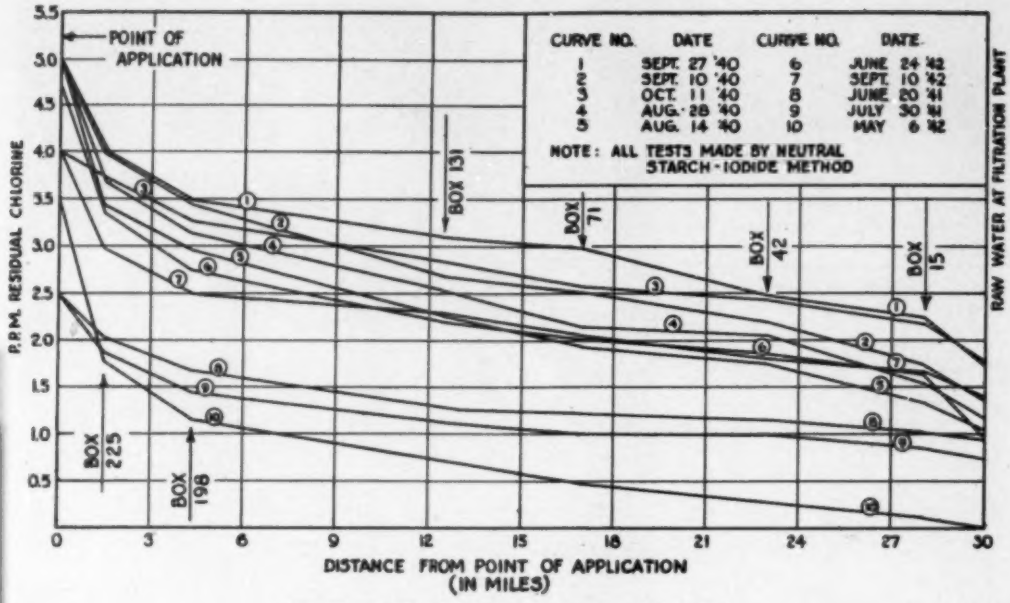


Fig. 2—Free Residual Chlorination Test Results on 33-Mile Line

year chlorination treatment was made. It had been evident for some time that little or no further gains in line carrying capacity could be expected, and that all further treatment should be based on holding the carrying capacity at the present point. Since free residual chlorination was rather expensive, some thought was given to finding a less expensive way of obtaining the same results.

### Intermittent Chlorination

At about this time, private communication with Charles E. Trowbridge, Chief Sanitary Engineer of the American Waterworks Service Company, Philadelphia, Pa., indicated that a different method of applying the chlorine, would give the same results at a much lowered cost. In this new method, which we call the Intermittent Method, chlorine is applied at a very high dosage (12.0 ppm.) for only one hour each week. For this very short treatment period, chlorine residuals as high as 8.0 to 10.0 ppm. enter the purificatiton plant, but cause no trouble since they last only a short time and are dissipated in the plant basins. It has never been necessary to practice any form of dechlorination. By changing to this type treatment, continuous chlorination of the water at the purification plant is now necessary, but a much lower dosage is required than was formerly used in the "break-point" process at Lake Winona.

The efficacy of this type of treatment is believed to be due, at least in part, to the fact that it prevents the slime organisms from becoming resistant to the killing action of the chlorine. The dosage is kept high enough to give maximum action in the allotted time of one hour. One hour each week is sufficient to keep the line in good condition. The saving in chlorine due to adopting this "Intermittent Method" of chlorination on the 39-in. supply line, is evident by the fact that an average of 125,000 lb. of chlorine was used each year under the "break-point" method, whereas only 70,000 lb. are required per year using the "Intermittent" Method.

The mechanics of applying the "Intermittent" Method are very simple. A wooden rack was built and placed upon a 500 pound platform scale. A 150 lb. cylinder of chlorine is placed, upside down, in the rack. A ¼ inch copper line connects the chlorine cylinder with a ⅜ inch iron pipe extending down into the Intake Tower in the lake. This ⅜ inch line is of such length as to submerge the lower open end at least 15 feet below the water surface, which prevents any chance of chlorine coming to the surface.

In operation, the treatment is controlled by manually setting the valve on the chlorine cylinder to get the required dosage. After a few trials it is surprisingly easy to do this, and any refinement of control, beyond this, is not necessary due to the high chlorine dosage being used. It is necessary to add the chlorine as the liquid rather than as the gas, since vaporization is rarely great enough to allow such a high treatment rate from a 150 lb. chlorine cylinder.

This method of chlorination on the 39-in. supply line has been in use since December 1949 and two friction coefficient tests have been made since that time. The results of these tests indicate that this form of treatment is equally as good, in our particular case, as the "break-point" method and considerably cheaper.

### Summary

In one year of operation, the capacity of a vital flow line was reduced 20% by organic growth, which could have been prevented had sterilization facilities at the head of the supply line been included in the original design. The ammonia-chlorine treatment was tried for a one year period, with only moderate success; then replaced by "break-point" chlorination. This treatment was used for nine years, during which time much of the original carrying capacity of the line was restored. In 1949, the "break-point" process was replaced by intermittent chlorination, using high chlorine dosages at very short intervals. This last method is in use at the present time and shows promise of giving good results at a lowered cost.

# WATER—Mysterious; Common; Strange; Destroying; Vital Water

*It Lives, It Dies, It is Resurrected.*

*by* W. B. WALRAVEN, *Civil Engineer*
*Springfield, Ill.*

FEW of us are conscious of the vital role which water plays in our lives, taking for granted that by turning a faucet we can produce an adequate supply which is at once sparkling, cool, and healthgiving. Fewer still know whence water comes, of what it consists and what it does.

Think if you will of a small droplet of vapor, high in a cloud. Follow it as it falls in the form of snow or rain toward the earth, pausing perhaps for centuries, locked in the heart of a glacier, but thawing at last and running into a streamlet which is a capillary vein of a mighty river system rushing ever downward to the sea. Visualize another drop as it falls upon a growing field to be absorbed into a stalk of corn, or another soaking downward to join an underground reservoir among the rocks where it may lie unmoved for countless ages. Regardless of the immediate fate of any droplet, it eventually finds its way back into the clouds, there to wait the repetition of the endless, ageless cycle of existence on the earth, in the sea, or in the air.

To many of the ancient civilizations water was sacred, as indeed it is to some of our present-day desert nomads to whom water is the power of life. The story is told of a French Officer who made a bloodless, though lasting conquest of a warring nation of North African nomads merely by showing them the great rivers of France. He invited a group of chieftains under flag of truce to accompany him to France to see for themselves the futility of further resistance. The group by-passed every military establishment and fort, but journeyed instead up the Valley of the Rhone, then turning westward, travelled down the mighty Garonne to the Gironde estuary. Here was more fresh water than the chieftains had dare dream of. Here was a nation possessing such limitless wealth and power that further resistance against it was clearly useless.

Except in certain areas, particularly our semi-arid Western States, we have enough water to satisfy our needs, although its storage and distribution may be a problem we may even suffer from its super-abundance when our streams go on a rampage. Having water in such lavish quantities we give it so little heed that for the most part both the technically educated and the layman hold fallacious views concerning almost every phase of its origin and existence.

## Water Isn't $H_2O$

To illustrate how prone we are to accept facts which are at best only partly true few persons besides the research physicist or chemist, knows that water is not simply a combination of two atoms of hydrogen with one of oxygen.

Recent news emphasis on heavy water in atomic energy studies has indicated that water is something besides $H_2O$ but when scientists tell us that in water more than 30 molecular or ionic combinations then water is indeed a strange substance. To further complicate the matter, ice is known to exist in at least six different forms, depending upon the pressure at which it is frozen.

There are countless other fallacious beliefs, but to catalog even a substantial portion of them would require the preparation of volumes so bulky as to require a special library. This paper therefore will be confined to some of the more common fallacies, supplemented by a brief discussion of a few of the lesser known but nevertheless interesting phenomena associated with water.

## Rainfall

Water evaporating from surfaces open to the atmosphere, weighs about five-eighths as much as the surrounding air. Consequently, it rises into the upper strata until it reaches a plane at which the rarefied atmosphere and lowered temperature bring the comparative densities into balance. A minute particle of water vapor clusters around a still smaller particle of dust in the air. This eventually collides with a similar particle, progressively expanding into a drop which is denser than a similar volume of surrounding vapor. It then starts to fall, and if there are many more particles acting similarly, rainfall results.

It is undoubtedly true that it is always raining at some place in the world and someone has figured that one billion tons of water fall upon the earth each minute. If all of the earth's surface including the ocean floor were level, it would be covered by a layer of water at least two miles deep.

In continental United States, the heaviest annual precipitation occurs in the Pacific Northwest, while the area embraced within the Great Smoky National Park runs a close second. In both areas the average rainfall exceeds one hundred inches per annum. Compared with 31 inches at Waukegan, Ill. or 49 inches at Cairo, Ill., this may seem to be quite heavy, but in comparison with some parts of India where the annual rainfall averages more than 900 inches, even Seattle is but slightly damp.

"Rainfall" as we speak of it includes that portion which is frozen before reaching the earth. We recognize three distinct forms of frozen precipitation; snow, sleet, and hail. Snow is vapor which has passed directly from the gaseous to the solid state. Sleet is rain which has fallen through a stratum of air sufficiently cold to cause freezing. It is associated with winter temperatures. Hail is usually a summer phenomenon, and it assumes its layered construction by being bounced up and down alternately in and out of the vapor laden clouds by strong, freezing winds. Physicists have calculated that in order for hail to attain a diameter of three inches, the icy winds in the upper air strata must have reached a velocity exceeding two hundred miles an hour.

## Curious Sources of Water

Unknown to many persons, there are many odd sources of water supply.

In our own desert there are varieties of cactus plants which store water for periods covering several years. If these plants are cut open the desert traveler may find a welcome source of water with which to allay his thirst.

The Bushmen of Australia are known to travel in the desert for weeks without carrying water. They seek out certain types of depressions in the ground which they excavate. At a depth of about three feet they find frogs whose stomachs contain as much as a half pint of water. This may be hard on the frogs, but the Bushman are thus able to live.

Archeologists exploring the ruins of the ancient City of Theodosia in the Crimea, were at a loss to explain the purpose to which the former inhabitants put certain stone structures built like bee hives with circular openings in the top. It remained for modern Italian engineers to explain their use. In the Libyan Desert they had found similar structures, filled with massive blocks of stone and equipped with floor drains. Air poured in at night through the openings at the top, descended and lost its moisture by being chilled on the stone surfaces. The water was collected in channels cut into the floor. Subsequent information tells us that the people of Theodosia had no water supply other than these curious stone bee hives.

New Delhi is the capital of India. Since the City was established as the Capital a comparatively short time ago, one might suppose that its people enjoy an ample water supply. On the contrary, thousands of natives in New Delhi stand in line for as long as half a day, while waiting to fill a water jar with the precious fluid. The only supply for 60,000 people comes from a single hose outlet. How different it is in our American cities!

### Evaporation and Transpiration

It is interesting to note what happens to rainfall. Some soaks into the ground as storage or for use by plants which transpire moisture to the air; some runs off to streams, ponds and lakes, and some evaporates either from the ground or directly from the surfaces of the water courses. During a severe drought year, evaporation may lower the water surface of a lake or impounded reservoir by as much as 30 inches. Three times this amount may be lost annually from a lake in Arizona or New Mexico. In many cases where a lake is used solely for a public water supply, and not for hydro-electric power, the amount lost by evaporation far exceeds the amount withdrawn for useful purposes.

In the middle United States, vegetation will utilize one-third of the rain during the peak of the growing season. Tremendous volumes are breathed or transpire from the pores of vegetation; a central Illinois corn field may evaporate as much as 5000 gal. of water from each acre every day during July and August.

This phenomenon greatly curtails the amount of electricity which can now be developed from the River Nile in Africa! For a long distance, the Nile flows through tremendous beds of lotus and lily. The broad surface of the lotus leaf breathes out or transpires great quantities of water, and the result is a serious curtailment of the flow of the mighty river system. Engineers are considering clearing extensive areas so that they may install greater electric capacity at the Assouan Dam.

While speaking of the Nile, it may well to bring out another apparent anomaly. Unlike the Mississippi River which becomes deeper and wider as it approaches the Gulf, the Nile grows smaller and smaller after it passes its middle reaches, because evaporation from its surface becomes greater than the added in-flow from its tributaries. The Mediterranean actually receives less water from all its tremendous tributary rivers than it loses through evaporation. This is proved by the fact that at Gibraltar the current runs eastward from the Atlantic Ocean into the Mediterranean.

As water evaporates heat is absorbed, and the remaining water is cooled. Witness the adobe hut of the Mexican peon, in which a goat skin filled with water cools the room as it seeps through the pores of the bag and evaporates. Better appearing, but no more efficient, cooling devices, which are being manufactured and sold in our Western States today, operate upon the same basic principle.

### Ice

Ice generally freezes first on the upper surface of a body of water, but under certain conditions of flow and temperature, the bed of a rapid mountain stream may be entirely covered with ice crystals, while the upper surface remains liquid. The huge intake shafts and tunnels, through which Chicago takes its water from Lake Michigan, often become so badly clogged with needle ice that the attendants have to dynamite the blockades. During certain seasons ice forms in swirling water and is carried beneath the surface, where it sticks to solid substances with which it may come into contact. Therefore the phenomenon is not only interesting but it also presents a serious economic aspect for those who deal with large water intakes or who handle hydro-electric installations in certain latitudes.

Water expands upon freezing. The volume increases about one-ninth if the freezing occurs at atmospheric pressure. Tests indicate that if the attempt is made to freeze water in a sealed vessel strong enough to prevent any deformation, the water will exert a bursting pressure up to a maximum of 30,000 lb. per sq. in. upon the containing walls. The ancient Romans realized that water expanded upon freezing, and quarried rock during winter by filling drilled holes with water.

The famous ship, Titanic struck an iceberg which towered one hundred feet above the water. How much of the ice was below the surface? Approximately eight-ninths or 800 feet of ice below the surface. What about an iceberg—is it salty? It is curious, but true, that upon freezing, ice crystals cast out the salt. Some of it may remain in the ice dissolved within the film of liquid water surrounding the individual ice crystals, but there is relatively little salt in an iceberg.

Incidently, we do not skate upon ice, but slide upon a film of water. We can skate because our weight, concentrated upon the sharp edge of the runner, melts the ice and the liquid water lubricates the path. It is quite difficult to skate when the temperature is below minus 30 deg. F. because the ice will not melt sufficiently.

It is interesting to note that at the instant of freezing, water gives off a considerable quantity of heat, known as latent heat of fusion. The amount is sufficient so that if it could all be utilized, the discarded heat would raise the temperature of an equal amount of water from 32 deg. F. up to 176 deg. F.

### Water Will Rise Above Own Level

Contrary to popular belief, water will rise above its own level. Like other material substances on earth, it is controlled by the forces which keep a body in a state of rest or of uniform motion in a straight line until impelled by other forces to move or to change direction. Water evaporates upon the application of heat. Being lighter than ordinary atmosphere, it is buoyed up and continues going upward until its density matches the density of the surrounding air. Sap flows upward in a tree because it is attracted upward by the molecules in the wood. Water has been known to follow a streak of rust up a steel column for great heights, the upward movement being a function of capillary attraction. In a like manner, wooden beams have been affected by the worst forms of wood-rot fungus even when they were far above any open source of water. In such cases examination usually discloses that there are continuous strands of wood-

rot fungus between some source of water and the elevated beam. Were it not for the upward percolation of water in the soil many of our farms would fail to produce crops during the hot summer months.

### Watering a Lawn

Why is a good rainfall better for our lawns than watering with a sprinkler? An average garden hose will deliver from 3 to 5 gal. per min., or approximately 0.5 cu. ft. per min. One-half cu. ft. per min. applied continuously for one hour, will deliver one quarter inch of water over an area 40 x 36 ft. This is not heavy watering.

After having been watered for a period of several years, certain types of grass will not grow well. The chances are that unless some counteracting condition is present, the ground will become too highly alkalized for the proper growth of lawn grass. Even comparatively soft tap water contains about 50 ppm. of calcium carbonate. Under the conditions mentioned above for watering a lawn, the garden hose will put 0.1 lb. of $C_aCO_3$ into the soil per hour. The degree of alkalinity built up obviously depends upon the concentration of alkaline minerals in the water and the amount of water applied. The effect is not severe for most water supplies. The alkalinity, however, may be corrected easily by applying fertilizer which leaves an acid reaction.

### Water A Great Destroyer

Water can and probably will destroy all of the works of man. It will either erode or sweep them away, rot them through the aid of fungi, or rust them. It has been estimated that of all of the iron taken from all of the mines of the world within the past 40 years more than 25 per cent has been destroyed by rust. Since iron rusts only in the presence of moisture, we see that water can and does return our iron back to the earth in much the same form as it was when mined.

Geologists tell us that thousands of years ago, the Mississippi River had its outlet into the Gulf of Mexico immediately below Cape Girardeau, Mo., which is about thirty-five miles north of Cairo, Ill.. The soil through which the Mississippi now flows came from up north, and one who has seen the great river below New Orleans can understand how rapidly the process is continuing. We in America are only now realizing the extent to which our top soils are being carried away.

As an example consider the Sangamon River in central Illinois. It is relatively small, having a drainage area of only 5000 square miles. In the fall of 1926, while in flood and flowing at the rate of 30,000 cu. ft. per sec., the water contained 0.3 per cent solid matter. On one day, during that flood the Sangamon carried away almost 500,000 tons of soil, most of which came from our farms.

When in high flood the Lower Mississippi will be flowing at fifty times that of the Sangamon and if the concentration of silt were only half as heavy, "Old Man River" would be carrying 12.5 million tons of farm land into the Gulf during each day of flood. This is equal to six inches of top soil spread over 10,000 acres; a staggering, irreparable, economic loss to the nation. Fortunately for us the rivers are not always in flood, but conditions are bad enough as is.

It may be the fate of man to return "to the vile dust from whence he sprung," but it seems that the rest of nature is headed for a watery grave.

### Chemically Impure Water

Chemically pure water does not exist in nature, and if produced in the laboratory will not remain in that state for long. Even the high upper strata of the air are filled with countless motes of solid matter which are attracted to the minute particles of water vapor. Every drop of rain contains at its center a tiny speck of foreign matter. In descending from the clouds the rain picks up carbon-dioxide and other gases from the air. Even before it reaches the earth, rain-water consists of many things other than hydrogen and oxygen, and when evaporated will leave a small residue of solids.

As soon as the water strikes the earth it begins to pick up mineral and organic matter from the soil. This process continues at a more rapid rate the more deeply it penetrates below the surface into the highly mineralized rock strata. Normally ground waters contain a few hundred parts per million of dissolved solids but oil field brines contain several thousand and a sample of water taken from a deep well near Decatur, Ill., contained more than 7.5 per cent or 75,000 ppm. of mineral matter. This is exceptionally high for ground water in this vicinity, although mineralized wells in other localities, notably Florida, may show a higher solids content.

While passing over and through the soil, water dissolves particles of every mineral it touches. Consequently, the chemical nature of the soil in a given locality determines to a large degree the mineral qualities of the untreated water supply. Generally, the most predominant minerals in water are bicarbonates and sulphates of calcium and sodium, with smaller amounts of iron, manganese, magnesium, sulphur. In some localities the water is high in sodium and calcium chlorides and lead, copper, zinc, silver, and gold may occasionally be encountered.

We are more aware of the presence of dissolved sodium chloride (table salt) than of other minerals, because of its association with the sea. The salt content of the Atlantic ocean is fairly constant at about 3.4 percent. The Baltic Sea, however, tributary to Northern Europe, has a salt content ranging from only 0.3 percent to 0.8 percent, while the Great Salt Lake in Utah contains about 23 percent. It has been estimated that if all of the oceans were to evaporate, enough salt would be precipitated to cover the entire earth with a blanket 360 feet thick.

The presence of gold dissolved in sea water opens up a field of interesting speculation. A ton of sea water contains approximately 3.5 grains of gold. If gold is worth $35 per Troy ounce, the oceans contain enough of the precious metal for each of two billion human beings to have $200,000,000 worth. Extracting gold from sea water may be a "day dream," now, but, it is well known that magnesium and bromine are being abstracted on a commercial scale from sea water, and it may not be too long before other valuable elements may likewise be recovered.

Not so many years ago even minute quantities of fluorine resulted in the rejection of a potential water supply, because in some localities the fluorides caused the mottling of teeth. Sanitarians and dentists now have a better understanding of the phenomenon and the controlled addition of sodium fluoride to water is being advocated to prevent tooth decay.

More than 20 cities in the U.S. are now adding approximately 1.0 ppm. of fluoride to drinking water and many more are considering the practice. Careful study is being made to determine the efficacy of the practice in the prevention of tooth decay.

This opens up a wide field of speculation and gives us a glimpse into possible mass community medication through the medium of the local water system.

Strangely enough, pure oxygen is regarded as objectionable in a municipal supply, although its presence is highly desirable in our open streams. Water holds more oxygen in solution when cold than when hot. Consequently we find that in winter the tap water is often high in oxygen. This causes iron pipes and other water

containers to rust rapidly. High oxygen or air content can sometimes be detected by observing a milky color in the water which disappears in the form of gas bubbles soon after leaving the faucet. This oxygen does us no bodily harm and is possibly good for us, but since it causes iron pipes to rust, Water Utilities would like to know how to get rid of it economically.

Many people believe that minerals occur in natural waters in sufficient proportions to be conducive to our general health, and we hear a great deal about the beneficial qualities of mineral waters obtained from springs from practically every section of the country. The truth is that one gallon of milk has the mineral equivalent of a bath-tub full of average Illinois well water. There is a decision in a law suit involving a certain brand of "Lithia Water" in which the court found that in order to obtain a single dose of Lithium equal to that which a doctor might prescribe after a single meal, one would have to drink 200,000 gallons of the so-called Lithia water.

Some chemicals in water may be harmful. Nitrates for example in concentrations above 20 or 30 ppm. may cause "blue babies." The nitrate is reduced to nitrite in the stomach, enters the bloodstream and prevents the use of oxygen by the blood. The patient may die of oxygen deficiency.

### Bacterially Impure Water

Viewed through a powerful microscope, a drop of pond water presents a drama of life as colorful, though perhaps not as interesting to some, as the drama unfolded in the teeming life of a city, containing as it does such a variety of plant and animal life that it would take many volumes even to catalog. This microscopic life has been found to exist over a temperature range which makes our own existence appear quite limited. Both plants and animals grow in water at temperatures as low as 36 deg. F. while other forms have been found living in water at 200 deg. F.

Although mankind suffers much from water borne diseases, only a few of the bacteria which are pathogenic to human beings are found living naturally in water. They neither thrive nor multiply in water, but merely live there temporarily because they have accidentally been so placed. Infectious water borne diseases are transmitted by bacteria which have formerly infested the intestines of animals. Streams may carry disease organisms for many miles, but under most conditions 70 per cent of the bacteria disappear by the end of the first week, while the sixth week will have witnessed the death of all but a few. Bacterial organisms live much longer in cold water than in warm and may exist in ice water for months. Consequently it may be dangerous to use ice obtained from some natural waters.

The Ganges River in India is perhaps the most interesting river in the world from the standpoint of pollution. Countless millions of people for untold generations, have polluted the stream, and it is the accepted practice for the bodies of human beings and the carcasses of dead animals to be thrown into the Ganges.

The river is unquestionably filthy, yet millions bathe in and drink from it. How does this come about? It is rather certain that the curious phenomenon known as bacteriophage has long since been established in the Ganges. The word is understandable when broken into its component parts, viz: bacterio—which we all understand, and phage which means "one who eats." Bacteriophage is a destroyer of bacteria and is found in the intestines, urine, and blood of human beings, particularly those suffering from a disease. It is believed to be either a sub-microscopic organism which attaches itself as a parasite onto a bacterium or enzymes or excreta from the bacteria. In either case, when the process exists, the bacteria disappear. This probably accounts for the bacterial purification of the Ganges. One is reminded of the jingle

"Big fleas have little fleas
Upon their backs to bite 'em;
And little fleas have lesser fleas
And so, ad infinitum."

As yet there is no certainty that the dread infantile paralysis can be spread by virus carried in polluted water, although there are numerous cases where the virus has been isolated from sewers draining homes in which polio was known to exist, and the virus has likewise been isolated from sewage and open streams which are badly contaminated with sewage.

In rural areas and in or near smalier communities, most water borne diseases arise from the use of contaminated springs or shallow wells. Springs have always been regarded as mysterious, and since many of them deliver cold, clear water, the belief prevails that they are endowed with miraculous powers of healing.

In spite of all that has been said about springs during the past fifty years, large sections of our population continue to cling to an almost superstitious faith in the efficacy of spring water and prefer to drink from possibly polluted sources rather than from a filtered, chlorinated public supply.

Sewers from the urban areas discharge an almost unbelievable pollution load into our waters, rendering them foully offensive and disease carrying. Fortunately we have sewage treatment plants operating in a great many cities, and these, together with the municipal water treatment plants, make it possible for the authorities to render the water supply safe.

The essential need for sewage treatment is exemplified by communities along the River Ruhr in Germany. The daily water pumpage from the Ruhr is seven times the average flow in the river. In other words, the water is used seven times, after which its salt content has reached an objectionably high level. If the sewage and water treatment plants failed to function the great Ruhr industrial area would suffer a staggering outbreak of water borne disease.

### Water Purification

In almost no case can an untreated natural stream or lake be used safely as a water supply for a city until the water has been filtered or treated chemically to remove contaminating materials. These may consist of mineral or vegetable matter, silt, tastes, odors, colors, and harmful bacteria. The amounts and kinds of objectionable matter depend upon local conditions.

The type of treatment will vary according to the objectionable material in the water, and in some instances the use to which the water is to be put. The plant which will treat Denver's supply successfully may not be satisfactory for Boston. In general the treatment of public supplies will include some combination of the following: a—Sedimentation, with or without the addition of chemical coagulants; b—addition of softening agents; c—filtration; d—disinfection with chemicals.

Certain waters may require specialized treatment beyond the scope of these steps above, but they are not common.

By what standards do we judge the desirability of our water? Almost everyone agrees that the most essential characteristics are freedom from disease organisms, unfailing continuity of supply, and satisfactory appearance. In addition to these, the American public is becoming acutely conscious of taste, odor, temperature, hardness, and the presence of metals such as iron or manganese which cause ugly stains. By accepted standards of competent judgment, filtered water from

almost any American city will meet all normal requirements practically all the time, although we occasionally encounter bad tastes, odors, color, and warm water particularly in summer.

While we should regard all untested waters as dangerous, we may be thrown into circumstances which make it impossible to find a safe supply, particularly when on fishing or hunting expeditions. It is obvious that we can purify water by boiling it. It may be well to point out that while boiling will usually remove all pathogenic bacteria, bacteriologists have reported the continued existence of the spores of bacilli which have survived fifteen minutes of hard boiling, but this should not deter us from drinking water which has been boiled for even five minutes. Water which has been boiled tastes flat and should be well aerated to restore its palatability.

Small quantities of water may be sterilized safely by the addition of iodine. Four drops of three per cent tincture of iodine stirred into a quart of water and then let stand for thirty minutes, should make the water quite safe to drink. Another simple method is to use sodium hypochlorite, (laundry bleach) which is sold in bottles at practically all grocery stores. Using a solution containing from three to five per cent of available chlorine, one may sterilize ten gallons of water by adding one teaspoonful of the hypochlorite and allowing to stand for one hour.

### Water and Fish Life

Organizations such as the Izaak Walton League for years have clamored for "pure" water in the streams of our nation, so that fish and other wild life may live. This is a most worthy motive, although it is interesting to note that fish will die quickly if placed in chemically pure water. These facts have little to do with the life of fish in our streams, for by "pure" streams we really mean clean water or streams which do not contain matter which prevents fish from living normal lives.

In order for a body of water to support desirable game fish, a considerable portion of it should be from six inches to twenty-four inches deep the year round, so that the fish may have adequate breeding grounds. Perhaps a third of the area of the body of water should have both submerged and emerging vegetation in order to supply an adequate supply of food. Another portion of the area should be deep enough for free swimming and for protection against natural enemies. The bottom should preferably not be sandy, although fish do like to swim in a stream which has a rocky or a gravelly bottom. To sustain proper plant life, a substantial percentage of the bottom should be covered with silt washed in from the stream banks, but this silt should be free from putrescible matter.

Water must also be free of chemicals which may harm or destroy fish or plant life. Carbon-dioxide is generated during the decomposition of organic matter and in the process, oxygen is consumed. Consequently, the presence of large quantities of carbon-dioxide will almost always indicate a lack of oxygen. Tests have indicated that if carbon-dioxide over the breeding grounds exceeds 6 ml. per liter of water, then fish will not thrive, and at higher concentrations eggs will be killed.

Most game fish thrive in water which is comparatively free from contamination, and they have a remarkably keen ability to recognize contamination and always attempt to leave water which is badly polluted although they are not always successful.

### Self-Purification of Water

One of the most persistent fallacies relating to water is the belief that natural waters have the ability to purify themselves of sewage pollution after flowing some given number of miles, or after the passage of some certain interval of time. Taken by itself, the distance of travel has nothing to do with the degree to which streams may overcome the effects of sewage contamination. In barest essence, the purification of a polluted body of water is accomplished by the action of microscopic organisms and oxygen.

Sewage treatment relieves the stream of the pollution load. Sewage treatment essentially takes water containing organic matter which is unsightly, odorous, and highly putrescible, and first removes the most readily settleable solids and, secondly oxidizes or stabilizes the remaining organic matter.

The principal criterion for the strength of a sewage is its demand or appetite for oxygen. It will be well therefore, to think of the oxygen of the stream as being used to stabilize the putrescible matter.

Quiet pools provide natural sedimentation basins in which the settleable organic matter may be deposited. This may be acted upon by many varieties of plant and animal life which thrive in the ooze, and eventually the organic matter is transformed into stabilized substances.

In a large stream which is but slightly polluted, there may be enough oxygen to supply the demand of the sewage without depleting the dissolved oxygen content below that required for the proper maintenance of fish and aerobic plant and animal life. On the other hand, the degree of pollution may be so high that all of the available oxygen is quickly used, and putrefactive conditions set in. Oxygen must eventually be supplied by absorption from the air and this takes time and agitation.

This sedimentation (and decomposition) and oxidation of organic matter by organisms is sewage treatment in the stream; it is self purification, and the time it takes depends on many factors.

Finally, however, the putrescible matter has been so altered that it bares scarcely any resemblance to its former condition, and its appetite for oxygen has been satisfied. Thus is the water recharged with oxygen, made clean, and the stream reborn as a fit habitat for the use of aquatic life and as a source of human enjoyment.

## Water In Industry

"WATER IN INDUSTRY" published by the National Association of Manufacturers and the Conservation Foundation is a 56 page brochure on a survey of water use in industry.

Containing data and charts as well as discussions, the brochure sets forth information on intake of water, sources of water, uses of water, reuse of water, treatment of water for use, treatment of waste, disposal of waste, water supply activities, water use per unit of product, and use of salt water. Both national summaries and regional data are given.

The report makes no attempt to formulate a water policy for American industry, but it is a factual summary that will be of great interest to all consulting engineers, as well as to public health departments, and to superintendents of local water and sewage works which are faced with the problems of industrial water supply and industrial waste treatment.

Copies of the report may be obtained from the National Association of Manufacturers, 14 West 49th St., New York 20, N.Y.; or the Conservation Foundation, 30 East 40th St., New York 16, N.Y.

WATER is so essential that no tyrant in history has ever dared deny it to those whom he might wish to administer the worst possible punishment.

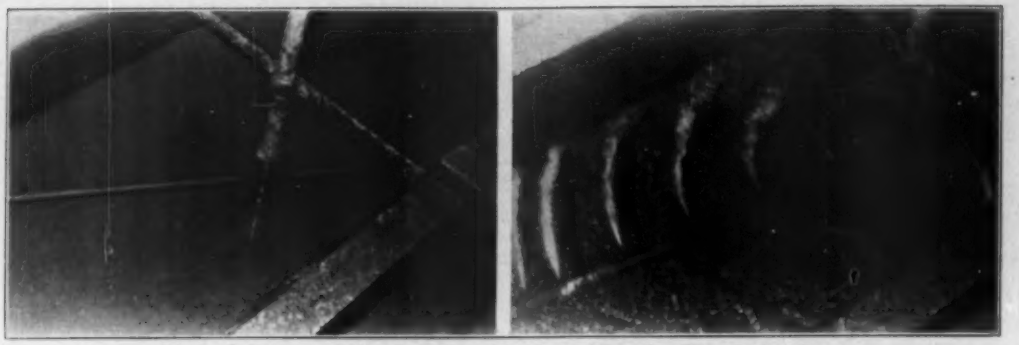

Fig. 1.—Left Agitator Before Operation—Right, Start of Operation, Filter Drained Down

# Anthrafilt and Rotary Surface Wash for Filters*

*by* C. E. PALMER, *President, Palmer Filter Equip. Co., Erie, Pa.*

SINCE the first item mentioned in the above title is Anthrafilt, we will begin by attempting to answer a few pertinent questions about this material.

### What is Anthrafilt?

Anthrafilt is a trade marked name for especially prepared hard coal and is used in the filtration of water for both municipal and industrial use. It is also the only practical filter material available for the filtration of acidic and alkaline chemical solutions. Large sizes of Anthrafilt are also used as a supporting medium in ionic exchange units.

When and where was Anthrafilt first used? Records show that Anthracite coal was used in filters at Cumberland, Md., and Dallas, Texas, as early as 1912. The material used at that time was dredged river coal. This material was, of course, ungraded and had a very high uniformity coefficient. These original installations were made under the supervision of the late James H. Fuertes.

In 1924, Fuertes also supervised the dredging of Anthracite from the Susquehanna River near Harrisburg, Pa., for shipment to Denver, Colo., where it was first graded and used in a 64 mgd. plant, which is still operating with the same material.

From 1930 to 1934 the late Prof. H. G. Turner and G. S. Scott, Research Engineers for Anthracite Institute, conducted experiments using a selected and prepared Anthracite coal, and from data gathered during this period the material now known as Anthrafilt was developed and placed on the market as a superior filter medium.

Why do we say a superior filter medium? Simply because of the many advantages of Anthrafilt over sand. What are some of these advantages? They are, its lighter weight, approximately 53 lb. per cu. ft. as compared to sand, at 100 lb. per cu. ft. Particles of the same effective size will require only half of the wash water rise to effect the same bed expansion. This fact alone effects an appreciable saving in wash water.

Further, the physical characteristics of the Anthrafilt grains differ considerably from grains of sand. Anthrafilt being angular and sharp edged has more plane surfaces than sand. This means that the hydraulic classification of a washed bed of Anthrafilt will give a bed of greater porosity with a greater entrapment surface than a sand bed of the same effective size. This fact naturally accounts for the higher rates or longer runs obtained by Anthrafilt filters. Repeated tests have shown that Anthrafilt of the same effective size as sand will remove more bacteria and considerably more turbidity at the same rates, and with the same pretreatment previously used with sand.

When filters are designed or equipped with adequate washing facilities and correct pretreatment, it has been proven that rates can be doubled with Anthrafilt and still guarantee an effluent equal or superior to sand.

Before the advent of chlorination, filters were used both for removal of bacteria and turbidity. This absolutely necessitated the use of a fine filter medium usually from .35-.45 mm. in effective size. Chlorination has now eliminated the danger resulting from water-borne bacteria. Subsequent demands for increased rates resulted in the study by waterworks men of pretreatment methods and led to our current processes of flocculation and sedimentation. This development of controlled pretreatment removed much of the load from the filters and made possible the use of a larger effective size of filter medium and increased rates.

### Meeting Increased Water Demands

Now, we come to a problem confronting filter operators all over the country, namely, the need to meet increased water demands resulting from growth of population and in-

*Presented before the New Hampshire Water Works Assn. and here published by permission.

dustrial expansion. Can filter facilities be expanded or must you figure out some way of producing more water with present equipment? Getting funds for an expansion program generally means a period of from 2 to 5 years after the initial steps are taken. How can you step up filter rates to meet the increasing demand during the interim period?

Making the logical approach to the problem, the first consideration should be the type of raw water you are processing and the adequacy of the equipment available to do the job.

If raw water is taken from a source in which the turbidity and bacteria count is low, you may not need any extensive pretreatment and consequently will not have to give it much thought.

On the other hand if you are using river water with flash periods of high turbidity or water polluted with industrial wastes, your pretreatment facilities already may be taxed to the limit. If such is the case, your first thought must be toward means of increasing the size of your flocculating and sedimentation basins to allow the proper time element at the increased rate of flow.

Installation of "around-the-end" baffles or the modern walking-beam flocculators can greatly accelerate the mixing and floc action of your coagulants. Sedimentation area should, of course, be increased to allow subsidence of flocculated turbidity but since this is not always readily possible, it may be necessary to let the filters remove a larger portion of the floc.

If the floc is small and fragile after leaving the flocculating basins, the addition of sodium silicate will speed up particle growth and toughen the floc to such a degree that it can readily be removed by the filter medium. Using a ratio of about 40 per cent activated silica to alum as a maximum dosage, excellent compact floc can be formed in about one-fifth of the coagulating time required for alum alone.

If possible, use free residual chlorination so as to assure highly efficient sterilization as well as a better control of tastes and odors.

The few items previously mentioned, of course, are only intended as suggestions because it would be impossible to cover the entire list of changes attendant to increasing rates in all types of plants under varying conditions.

A second main consideration in meeting the increased demand for water must be to ascertain if the underdrain or collection system and rate controls are adequate and in condition to handle increased rates of filtration. Many plants are definitely limited in this respect to a maximum of 2 to 3 gpm. per sq. ft. or less. Increasing pretreatment and changing filter materials is a waste of time and effort if underdrains and controls are a limiting factor. Careful inspection and cleaning of underdrains prior to placement of new filter medium and reconditioning of controllers or change of orifice plates will more than repay the time spent.

### The Problem of Backwashing

Now, we come to the phase of rate increase which usually holds up the procession. Increased rates of filtration necessitate the use of a larger effective size of filter medium, but if the backwash is inadequate for the present size of sand, how can you increase the size of the medium and even begin to clean it properly? The answer that hundreds of filter operators have arrived at is Anthrafilt filter medium and rotary surface wash.

As explained earlier, Anthrafilt weighs only about one half as much as sand per cubic foot and therefore generally requires 30-50 per cent less wash water for the same effective sizes of material. This means then that small sized sand can be removed and replaced with larger Anthrafilt and proper bed expansion can then be obtained with your present backwash supply.

Will a coarser medium result in passage of floc? Let's answer this by saying that current users of 10,000 to 12,000 tons of Anthrafilt per year are all getting better water at higher rates than ever before when using smaller sizes of sand. It is also well known that many industries require a quality of process water much better than the average domestic supply and every year increasing numbers in the paper, chemical, synthetic fabric and oil fields are changing over from sand to Anthrafilt.

In addition to higher rates, Anthrafilt will give longer runs because it does not hydraulically classify in the manner of sand. In other words, the particle sizes throughout the entire bed depth are more nearly of a size and the specific gravity holds much closer to a given figure. Consequently, the entire bed of No. 1 Anthrafilt enters into the filtering process, not just the top 2 to 3 inches as is the case with sand. Loss of head builds up very quickly in sand beds because this thin layer of finer material becomes loaded with flocculated turbidity and immediately becomes the rate control factor for the balance of the bed.

It is, of course, true that in an Anthrafilt bed the upper portion will likewise become loaded more quickly than further down, but the particle size being larger and more even, allows the passage of some of the floc to greater depths before entrapment occurs. Consequently, filter runs are roughly 3 to 4 times longer

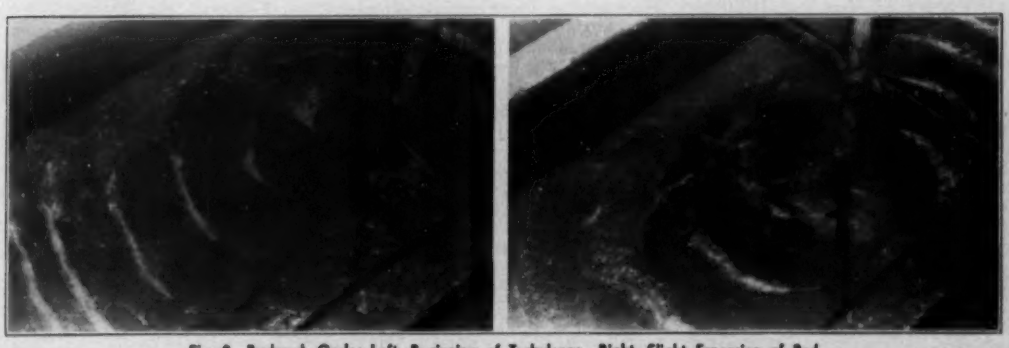

Fig. 2—Backwash Cycle: Left, Beginning of Turbulence—Right, Slight Expansion of Bed
*(Note increased turbulence set up by agitator jets as filter bed expands)*

**Fig. 3—Backwash Cycle Continued—Agitator Arm Partly Covered, Turbulence Increased.** *(All operating photos from Dalecarlia Filtration Plant of the Washington Aqueduct, the Water Supply Division of the Washington District, Corps of Engineers.)*

with an Anthrafilt bed under the same conditions as for a sand bed.

Now, what does this mean to you operators who must obtain an increased output? In all probability there will be a heavier load on the filters because of inadequate pretreatment due to the increased demand for more water. You may have increased chlorination, speeded up flocculation and possibly discovered some means of assisting subsidence in the sedimentation basin, but when all is said and done, you are no doubt putting water onto the filters with 25 to 50 per cent more floc content than previously. You can imagine what would happen to sand filters which were already incapable of handling peak period loads.

Suppose you change from sand to Anthrafilt and plan to place a maximum possible load on the filters. Although rate efficiency has roughly doubled the rate with sand and the wash water situation has improved, the filters will be loaded with incompletely formed or unsettled floc. This condition has a corollary with which you must begin to cope.

Increased application of flocculated turbidity on filters resulting from increased rates adds up to one simple answer. Increased backwashing regardless of longer filter runs. If the balance between rates, filter runs, and backwash supply is not proper some outside aid must supplement the backwash in order to keep the filters clean and capable of operating at sustained high rates. The only proven method of doing this economically is rotary surface wash.

## Rotary Surface Wash

Rotary surface wash or, as they are more commonly known, filter bed agitators have been developed expressly as an aid for filters having inadequate backwash facilities and to guarantee continuously clean filters capable of continued high rate filtration where backwash is considered adequate.

Palmer filter bed agitators, (to give them their well-known trade name) are designed to operate with a minimum consumption of water, approximately 0.5 gpm. per sq. ft. No outside electrical or mechanical means of power is required. Opposed nozzles on revolving arms, extending horizontally from a central water sealed bearing, emit high velocity jets downward at an angle of 15 degrees into the filter medium. Operating pressures vary from 40 to 150 psi. depending upon length of arms and number of units required per filter.

Operational procedure is as follows: Drain the filter down through the regular effluent line until only 4 to 6 inches of water remains above the top of the filter bed. Shut off effluent valve. Open agitator control valve on to full position. Open backwash valve slowly until entire filter bed of fine material is expanded to the interface of first supporting layer of gravel. This can be ascertained readily by inserting a broom handle vertically into the bed. When the fine material has fully expanded, there will be no difficulty in feeling the gravel layer. Mark this degree of opening on the backwash control valve and adhere to this procedure henceforth. Generally, this opening will be considerably under the previous backwash rate.

When agitators are installed in filters with old sand or Anthrafilt they should be operated for the entire backwash during a number of backwash cycles. A definite, sustained increase in removal of turbidity during the entire backwash period and for several periods thereafter will be noted until all entrained turbidity is removed. As soon as the filter media is cleared of this entrained turbidity, the operation of the agitator can be reduced to 3 to 5 minutes maximum time for each washing. In filters equipped with new sand or Anthrafilt, the 3 to 5 minute interval can be used as soon as initial washes have removed the small percentage of "fines" or undersized material inherent to all filter material.

## Removal of Fines

This removal of "fines" is a point which many operators overlook on the placement of new filter medium. Regardless of type of filter material, or source, there is generally about 1 to 2 per cent of fine material well under the effective size ordered, which it is not economically feasible to remove in commercial production. Removal of these "fines" is easily accomplished in the filter immediately after the material is placed. Merely operate the filters at maximum rates of backwash, or at a rate sufficient to carry off "fines" to the sewer. Observe this operation quite closely, particularly with the lighter Anthrafilt, to be certain that you are not losing standard effective sized material.

This operation may require 2 to 3 hour backwashing on 3 to 4 days before all "fines" are removed. An operator will be more than repaid for this initial loss of water and time in terms of higher sustained rates throughout the life of the filter material. "Fines" are hydraulically graded to the top of the filter and immediately affect the primary loss of head and become a natural factor governing the length of filter runs from then on.

## Development of Filtration Practice

We will revert for a time to one of the old time ideas about filtration. To use historical facts, at one time before pre-chlorination, it was thought necessary to maintain either a so-called "schmutzdecke" or to have medium particles coated with a certain amount of biological or floc coating in order to assure proper filtration. The introduction of prechlorination definitely eliminated

this procedure which was based upon the theory that biological cultures, if strong enough, would form a mat or deck and attract and strain out subsequent bacteria. As a matter of fact such operation did remove up to 98 per cent of the bacterial content in water at low rates of filtration. High filter rate demands made this impractical, however.

During the period which encompassed slow-sand filters and early stages of rapid sand filters, the general idea was to handle filter medium with kid gloves to preserve this coating. With the advent of prechlorination, followed, or let us say simultaneous with, the development of coagulation led to the theory of "give the filter particles H-E-L-L so that they will be clean at all times for the entrapment of coagulated turbidity or floc."

From that time on we have had controversy about the degree of expansion necessary for proper cleaning of beds during backwash; some claimed 30 per cent was sufficient, others claimed 50 per cent was required. Actually 50 per cent expansion only means increasing the water cushion between filter particles. Likewise expansion under 30 per cent does not give sufficient impingement of particle on particle for removal of coated or entrained turbidity. What then was needed?

Early experimenters in the filter field turned to air wash which for various reasons proved impractical. Stationary surface wash was then developed but installation and operating costs have generally been out of line with results obtained. Then rotary surface wash was developed, and has definitely proven itself to be the answer to the means of economically cleaning filters and keeping them clean.

Undoubtedly the best proof of the above statement in regard to rotary surface wash, or agitators, as for Anthrafilt previously mentioned, is the fact that in every case where one filter was equipped experimentally, subsequently the entire plant has been equipped. This is testimony that rotary surface wash equipment actually does the job for which it is designed.

We are currently entering a cycle of increased expansion of industry and concentration of population which will certainly lead to a constant and insistent demand for more and more water. At the present it looks very much as if construction material is going to be limited to cases of actual necessity. Correct application of suggestions made herein, and utilization of Anthrafilt and agitators can certainly help with some present or future filter problems.

Fig. 4—140 Palmer Filter Bed Agitator Units Ready for Shipment to an Ohio Filter Plant.

## H. T. Rudgal to Manage Gary-Hobart Water Corp.

Harold T. Rudgal assumed the position of Vice-President and General Manager of the Gary-Hobart Water Corp. April 1, 1951. Rudgal, a 1925 Drexel graduate, was employed by Alvord, Burdick & Howson, Consulting Engineers, from 1925 until 1940. From 1940 to 1947 he was Superintendent of the Sewage Treatment Plant at Kenosha, Wis. From 1947 until 1951 he was Superintendent of the Kenosha Water Department, resigning to go to Gary in his new capacity.

The Gary-Hobart Water Corp. took over the water utilities at Gary and Hobart, Indiana, April 30th, from the previous owners, the Northern Indiana Public Service Co. The Hobart supply is from Lake George; the Gary supply from Lake Michigan. An early project will be the construction of a 48 mgd. filter plant to improve water quality at Gary.

The Gary-Hobart Water Corp. is owned by the Mott interests. Other Mott utilities are operated by Illinois Water Service Co., Northern Illinois Water Corp., Long Island Water Corp., Missouri Water Co., and St. Louis County Water Co.

Herbert L. Plowman, Secretary, Auditor and Office Manager of the Gary-Hobart Water Corporation has been in the employ of Northern Indiana Public Service Company and is a longtime resident of Gary. W. Victor Weir, President of the other Mott water utility companies, is also President of the Gary-Hobart Water Corp.

## 12 States Prohibit Strikes in Public Utilities

States which have laws designed to prevent strikes in Public Utilities by making settlement of labor disputes compulsory are Virginia, New Jersey, Indiana, Pennsylvania, Massachusetts, Florida, Wisconsin, Michigan, Missouri, Minnesota, Nebraska and Texas.

# Graphical Approach to Statistics*

*V—Tests for Statistical Significance (Section A)*

*by* C. J. VELZ, *Chairman, Dept. of Public Health Statistics*
*University of Michigan, Ann Arbor, Mich.*

COMPARISON is a common method of appraisal. Observed differences or simularities may not be significant, as they may arise solely by chance. The purpose of this article is to present graphical methods to test the statistical significance of such apparent differences before drawing conclusions from comparisons.

Tests for statistical significance cannot *prove* a cause and effect relationship. The contribution of statistics is to define the expected variations due to chance. Actually, any difference in results, no matter how great, can always be ascribed to chance, but a point is reached where the probability that the difference is due to chance becomes so small that the investigator prefers to ascribe the difference to other causes. The decision that the difference is not due to chance and the subsequent search for the underlying *cause* of the difference is completely outside the realm of statistical technique and is entirely a matter of professional judgment of the specialist in the field. The statistical method is only a tool, not a substitute for reasoning.

*Parts I, II, III and IV appeared in May, August, October 1950, and February 1951, respectively.

## Testing a Single Series

### Normality

The most important test applied to a single series is to determine if the distribution of individual measurements is *normal*. Graphically this is accomplished by plotting the data on probability paper described in the preceding articles. If a straight line is formed, the distribution is normal and symmetrical; if curved upward or

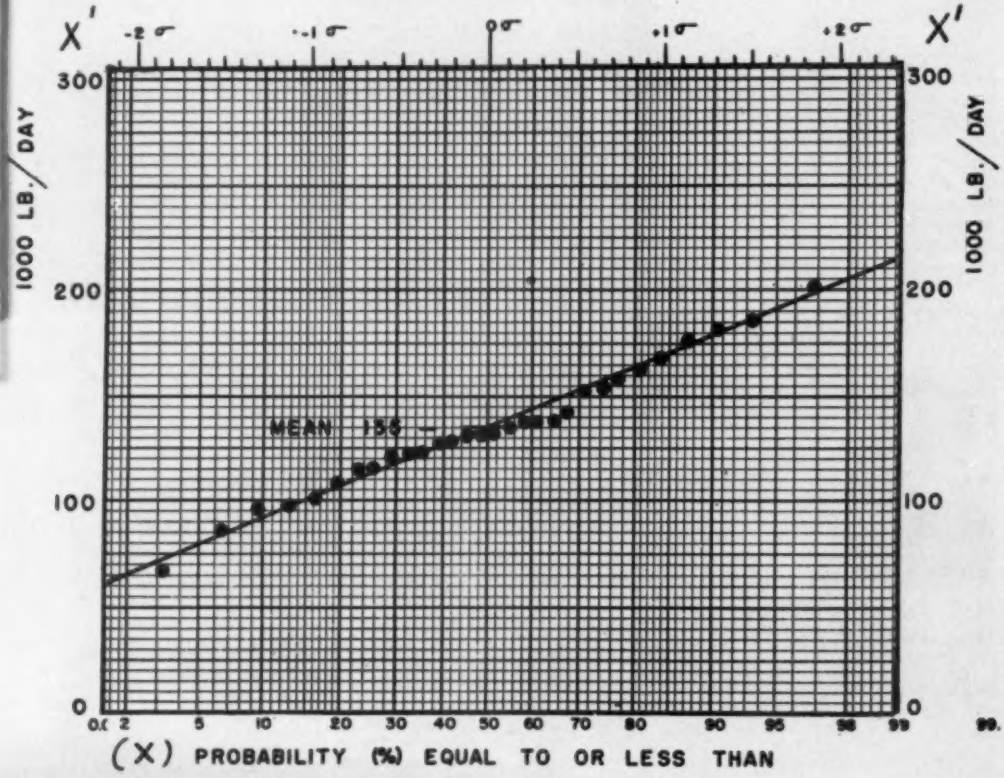


Fig. 22—Illustration of a Normal Distribution of Suspended Solids
*(Buffalo Sewage Works—Nov. 1939—Data Supplied by Geo. Fynn.)*

downward, the distribution is skewed and asymmetrical. This is at once visually apparent. If a distribution plots as a straight line (is normal), then the raw data may be condensed, without loss of significance, to three summary figures:

(1) The Mean (Arithmetic Average)
(2) The Standard Deviation ($\sigma$)
(3) The Number of Observations (n)

Such a normal distribution is illustrated in Fig. 22, Suspended Solids for Buffalo Sewage for the Month of November 1939. Suspended solids are expressed on a quantitative basis computed from the concentration in parts per million and the daily volume of sewage in million gallons. Since a straight line is formed, the distribution is normal and may be summarized by the three statistics:

| | |
|---|---|
| Mean (Y graphical) | = 135. |
| Standard Deviation ($\sigma$ graphical) | = 34. |
| Number of Observations (n) | = 30. |

However, if a distribution does not form a straight line (is not normal), such summary statistics can be very misleading. The superiority of the graphical approach over the usual analytical methods is illustrated in the following examples.

### Abnormal Breaks in Data

Routine water and sewage treatment works operating data are at times subject to abnormal breaks in otherwise normal variations. This is usually associated with sudden hydrologic changes which radically alter conditions. Figure 23, Line A, shows a distribution of daily suspended solids determinations for influent of Buffalo Sewage Treatment Works for the Month of August 1939. A sharp break from an otherwise normal distribution (Line A) is noted at the right upper end. Precipitation records for August show that the values which break away from the distribution were associated with the first day of rainfall flushing the combined sewer system.

The question now arises, show shall such data be summarized? The best summary is the graphical plot itself, as this is the only method clearly to differentiate between the normal and abnormal segments without loss of significance. Neglecting the graphical approach and attempting condensation of data by analytical statistical methods alone leads to two common misrepresentations:

1. Neglecting to test for normality and computing an arithmetic average and a standard deviation gives

| | |
|---|---|
| Mean ($\bar{Y}$ computed | = 197.6 Thd. lb. per day |
| Standard Deviation ($\sigma$ computed) | = 137.3 Thd. lb. per day |
| Number of Observations (n) | = 31 |

Such an analytical summary would lead one to believe that the distribution was normal and, if this mean and standard deviation are reconstructed on Fig. 23, it would produce a distribution represented by Line B. Visually, it is apparent that Line B is too high and too steep and is obviously inconsistent with the bulk of the actual data. In attempting to define both the normal and the abnormal segments, it defines neither and, in fact, gives a false summary which is "non-sensical" in relation to the actual observed facts. Such a summary is dangerous.

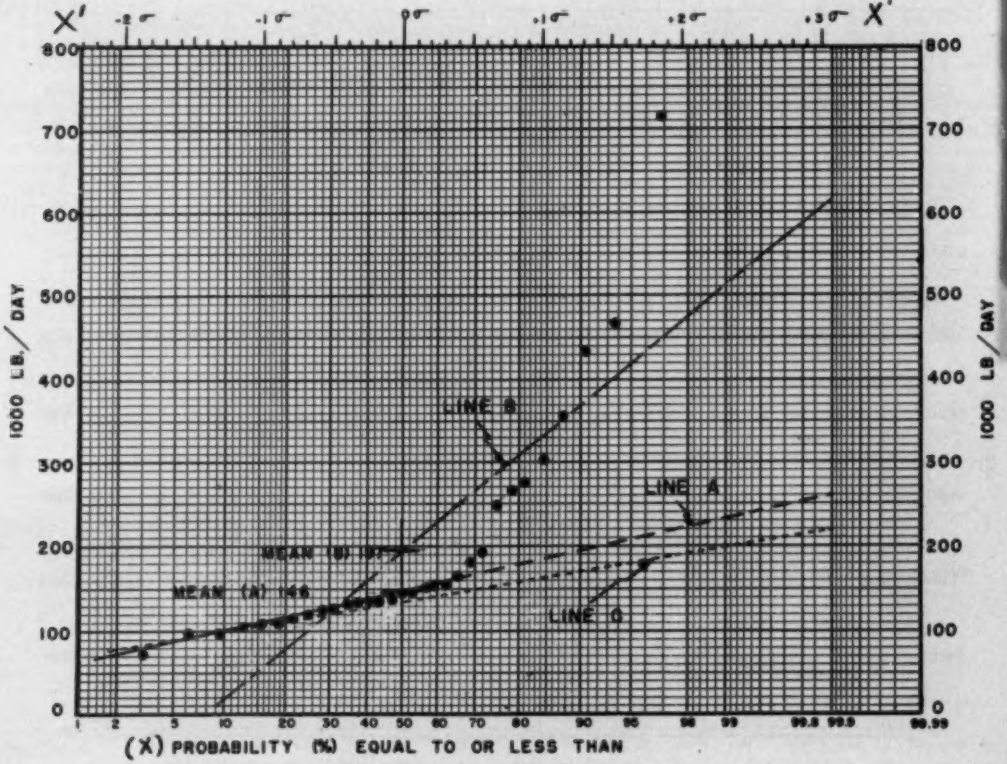


Fig. 23—Illustration of Abnormal Break in a Distribution
*(Suspended Solids in Buffalo sewage—Aug. 1939—Data Supplied by Geo. Fynn)*

Table 8

COMPARISON OF ANALYTICAL AND GRAPHICAL STATISTICAL SUMMARIES OF SUSPENDED SOLIDS

Buffalo Sewage Treatment Works Influent
*July 1939-January 1940*

| Month 1939 (1) | Analytical Summaries: Computed mean 1000 lb./day (2) | Analytical Summaries: Computed σ 1000 lb./day (3) | Analytical Summaries: n (4) | Graphical Summaries: Graphical mean (Normal segment) 1000 lb./day (5) | Graphical Summaries: Graphical σ (Normal segment) 1000 lb./day (6) | Graphical Summaries: n (7) | Remarks (8) |
|---|---|---|---|---|---|---|---|
| July | 182.9 | 139.3 | 31 | 153 | 39.0 | 31 | 85% normal followed by sharp break with 15% distinctly abnormal |
| August | 197.6 | 137.3 | 31 | 146 | 37.3 | 31 | 65% normal followed by sharp break with 35% abnormal |
| September | 206.1 | 173.5 | 30 | 166 | 48.0 | 30 | 75% normal followed by sharp break with 25% abnormal |
| October | 174.0 | 123.1 | 31 | 139 | 40.0 | 31 | 80% normal followed by sharp break with 20% abnormal |
| November | 134.9 | 30.8 | 30 | 135 | 34. | 30 | complete distribution normal |
| December | 167.2 | 104.6 | 31 | 140 | 42.7 | 31 | 80% normal followed by sharp break with 20% abnormal |
| January, 1940 | 141.4 | 39.4 | 31 | 142 | 41.8 | 31 | complete distribution normal |
| July, 1939-January, 1940 | 172.0 | 118.1 | 215 | 147 | 42.7 | 215 | 85% normal followed by sharp break with 15% abnormal |

2. Excluding the abnormal values and then computing an arithmetic average and a standard deviation gives

Mean ($\bar{Y}$ computed) = 132.6 Thd. lb. per day
Standard Deviation ($\sigma$ computed) = 27.5 Thd. lb. per day
Number of observations (n) (8 largest values excluded) = 23.

This mean and standard deviation would reconstruct a distribution represented by Line C. Visually, Line C is too low and too flat. Excluding the 8 largest values completely ignores the abnormal segment and does not adequately represent the normal segment. Obviously, the deletion of the 8 largest values of a series of 31 values, even if they were in line with a normal distribution, would unduly reduce the mean and the standard deviation. "Throwing out" data is a dangerous procedure.

If a non-graphical condensation of data is insisted upon, it is best obtained through a graphical approach. Referring to Line A, Fig. 23, such a condensation of the raw data might be suggested as follows:

1. Approximately 65 per cent of the distribution is normal followed by a sharp break with the upper 35 per cent distinctly abnormal. (8 values distinctly out of line ranging from 248 to 717 Thd. lbs. per day)

2. The *normal* segment of the distribution is defined by

Mean ($\bar{Y}$ graphical) = 146 Thd. lb. per day
Standard Deviation ($\sigma$ graphical) = 37.3 Thd. lb. per day
Total number of observations, normal and abnormal (n) = 31.

Such a summary, while no substitute for the actual published plot on probability paper, is at least consistent with the facts as observed and is not misleading.

As further emphasis of the value of the graphical approach, Table 8 contrasts the graphical summary statistics with the analytical summary statistics of the operating data for the Buffalo Sewage Treatment Plant for 7 months, July 1939-January 1940.

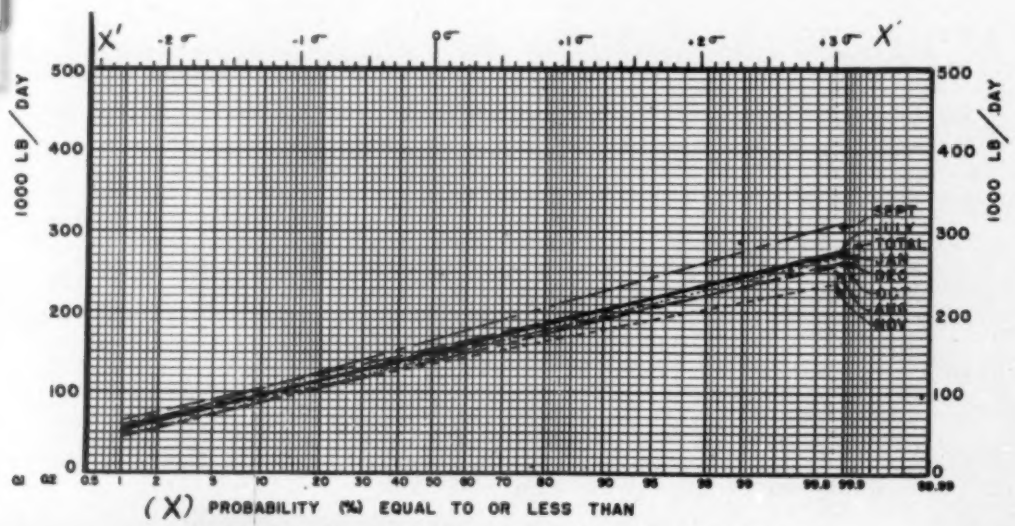


Fig. 24—Illustration of Graphical Test for Similarity Among Several Distributions

It will be noted from Table 8 that the normal suspended solids load to the treatment works from month to month, uninfluenced by rainfall flushes, is reasonably constant as reflected by the graphical means shown in Column (5). This is to be expected from a given population and normal industrial activity not subject to seasonal patterns. The day to day variability as reflected by the graphical standard deviation, Column (6), is also reasonably constant.

In contrast to this, there is a wide variation reflected in the analytical summary of computed monthly averages and standard deviations as shown in Column (2) and (3). November and January are of special significance because the complete distributions were normal without any breaks. Rainfall during these months was light and probably occurred as snow and hence flushing of the combined sewers did not take place. For the graphical summaries, it is noteworthy that the means and standard deviations of the other months tie in closely with these two months.

In contrast, however, the results of the analytical summaries show wide variations in means and standard deviations for the other months when compared with November and January. Note, also, that only when the complete monthly distribution is normal (November and January) do the analytical results approach the graphical.

In appraising treatment works loading and performance, it is obvious that the all too frequently employed "Monthly Average" may be a very misleading figure. It is essential to differentiate between the normal and the abnormal before drawing conclusions or making comparisons.

## Testing Two or More Series

### Differentiating Among Series

Plotting two or more series of data on the same sheet of probability paper affords a quick visual appraisal of similarities or differences. For example, assume that the distributions summarized on Table 8 are all normal distributions as represented by the means and the standard deviations. Figure 24 represents the reconstruction of the normal distributions of the graphical summaries, Columns (5) and (6) in Table 8. The eight distributions cluster about the common mean and disclose similar slopes. The visual pattern strongly suggests similarity among the distributions.

In contrast, reconstructing distributions from the analytical means and standard deviations of Columns (2) and (3) in Table 8 (Fig. 25) indicates marked differences among the distributions, not only as to position of the mean but also as to slope. Such graphical differentiation affords a quick appraisal and points out areas where further testing between two distributions may be warranted.

(Ed. Note:—Because of space limitations it was necessary to divide this article—Part V of the series—into two sections. The concluding section of Part V will appear next month.)

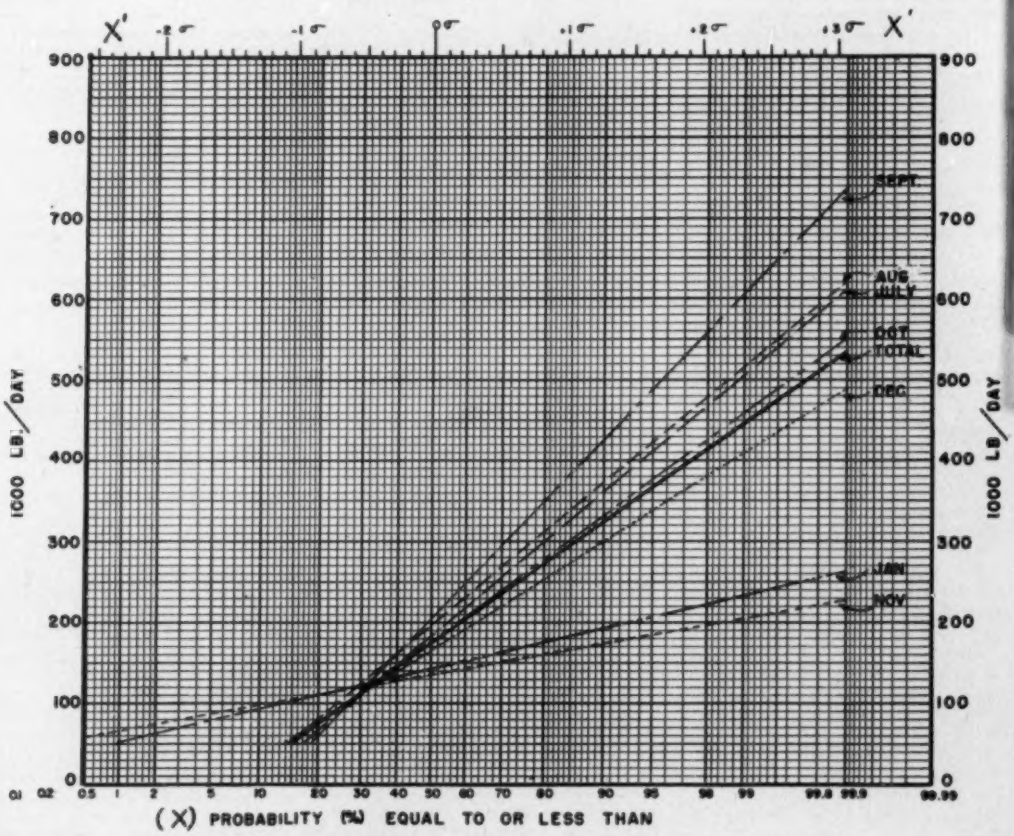


Fig. 25—Illustration of Graphical Test for Difference Among Several Distributions

# Anguillula

*May mean "little eel" to the biologist; but just a big headache to the water works man.*

*by* J. M. CAIRD, *Chemist & Bacteriologist, Troy, N.Y.*

PHYSICIANS often discuss the ailments of some of their patients without identification, and it is evident that sometimes "what people do not know never hurts them."

The water supply in the subject case is obtained from a stream; liquid chlorine being applied at the raw water pumping station and sulphate of alumina is added before the water enters the flocculation basins. From thence it flows to the *covered* settling basins and then through the filters. After filtration, liquid chlorine, ammonia and lime are added before the water enters the *uncovered* reservoir, which is brick-lined and cement-washed.

This reservoir is about 26 feet in depth, the capacity being about two days supply. The water enters at the surface and is withdrawn from several depths into the distribution system. Three 20-inch mains connect the reservoir with the distribution system.

### "Worms in Our Drinking Water!"

Complaints were received that the water contained "worms"; the location being in only *one* section of the city and confined to a very small area, only six houses reporting this condition.

Microscopic examination showed the "worm" to be *Anguillula,* and inspection of the house plumbing showed no cross-connections. Although the public press gave plenty of publicity, no complaints were received from any other section of the city. None of these "worms" were found on top of the filters.

### The Source

*Anguillula* is found in fresh water snails and birds; inspection of the open filtered water reservoir revealed their presence. No snails were found; hence the source is presumed to have been the birds flying over the reservoir.

The filtered water entering the reservoir has an alkalinity of 26 parts per million, residual chlorine of 1.0 part per million, and a pH of 8.2. The water temperature was 84° F, and it was thought that with cooler weather a reduction in temperature would kill the growth. Some of the "worms" were placed in the dark in an icebox where the temperature was 40° F. This temperature was not sufficient to kill the growth.

### Copper—Chlorine Effects

Some laboratory experiments were made, using copper sulphate and liquid chlorine in different doses, with the following results.

| PPM Cu SO4 | | PPM Resid. $Cl_2$ | Worms Survived |
|---|---|---|---|
| 0.7 | with | 2 | 10 days |
| 0.7 | " | 3 | 3 " |
| 0.7 | " | 5 | 3 " |
| 1.2 | " | 1 | 3 " |
| 2.6* | " | 0 | 10* " |

*"Worms" absorbed a blue tint but that was all.

After considering conditions, operation was started using copper sulphate at the rate of 0.5 ppm. After ten days this was increased to 0.7 ppm, and again increased to 1.0 ppm. after ten days. During this time the residual chlorine was maintained at 1.0 ppm. No "worms" were found after thirty days of this treatment. It would appear that a prolonged treatment of copper sulphate and liquid chlorine was effective in killing *Anguillula*—the "little eel."

The dead "worms" were removed from the surface of the reservoir, using a fine copper screen.

Rideal, in his text—"Water and Its Purification," states:
"A small round worm, called *Anguillula,* is common in rivers and ponds, and sometimes makes its way into London waters. It is believed to be capable of living in the human intestine, and therefore might be dangerous, and must be regarded as a very bad feature in a potable water."

During this period no complaints of any illness were received, and most strange to relate, not even a guppy or a gold fish was reported killed.

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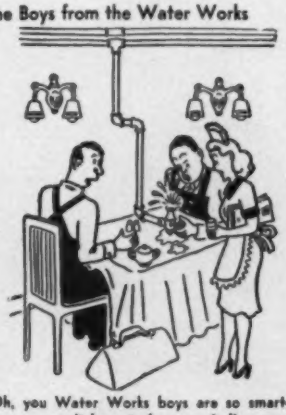
## Deinking Sludge Disposal Tests*

Extensive research conducted by individual mills and the Council exploring possible uses for deinking sludge have revealed no use of any great promise. Mitigating against its use are its variable composition and changing physical characteristics. Means for disposing of this voluminous and hydrous residue are now being investigated on a large scale. Two New England mills are presently dewatering the sludge to a solids content of thirty percent and employing it in a joint land fill project with a municipality. After freezing and thawing, further dewatering takes place and the material stabilizes. Bearing tests of filled areas will be made this summer to determine stability which appears good since trucks are supported by older filled areas.

Seepage beds are being tested by a Michigan mill to determine drainage and drying properties of the residue over a long period of time. Sludge of ten percent solids content is discharged direct from the clarifier to these beds. Measurements and periodic tests of the contents are made. In conjunction with these experiments ultimate disposal of the dried residue on agricultural land for the purpose of improving the characteristics of certain types of soils will be made in conjunction with a local agricultural experiment station.

*From the National Council for Stream Improvement, Inc.

### The Boys from the Water Works



"Oh, you Water Works boys are so smart—now, you won't have to keep reminding me to bring your water."

# Legal Aspects of Industrial Waste*

*by* JOHN H. MURDOCH, JR., *Vice President and Counsel, Amer. Water Works Service Co., Inc., Philadelphia, Pa.*

THE only industrial waste problems considered in this paper are those connected with stream pollution. The purpose is to show how certain fundamental legal principles are involved in attempts to solve the complicated problems before this conference. These principles are those which must underlie legislation and are those which will be influential in guiding the minds of the courts in passing upon or enforcing legislation. Further, these principles must be sensed by the public and by industrial leaders before a genuine stream improvement program can be carried to a successful conclusion. The legal principles are comparatively simple but the factual situations in which they must be applied and in the light of which legislation will be considered are complicated. To show what the principles are, a hypothetical but typical state of facts will be presented and the legal principles will be stated in relation to those facts.

### A State of Facts

Assume a section of the country divided into two main watersheds of equal size. The two watersheds have natural resources identical in kind and quantity and availability. Transportation facilities are in no way dissimilar and distances from markets are the same. In main watershed "A," there is a highly developed industrial section drained by Somewhere Creek with a town at the mouth of the creek and depending on the creek for its public water supply. Industry in that section has developed slowly over a long period of years. A coal mine far up the valley has been in operation for many years and has always produced acid mine water which flowed into Somewhere Creek. Because of the large flow in the stream the mine water seemed to produce no ill effects on lower riparian owners or downstream communities. A new mine was later opened farther upstream which also produced acid mine water which flowed into the creek. This acid mine water from the new mine combined with that from the older mine rendered the water in the lower reaches of the watershed, acid and corrosive and unfit for domestic and industrial use.

A number of other industries along the creek produce a variety of industrial wastes. Some of those wastes are toxic in certain concentrations but harmless in the concentration which would result from adding the effluent of the industry to the low flow of the creek in its natural state. The interactions of the wastes from the industries with the acid mine water in the river intensified the undesirable character of the water reaching the town at the mouth of the creek.

In main watershed "B," there are no industrial developments and no mines although the natural resources and the location are as favorable to such development as are those in main watershed A. One valley in watershed B is Nowhere Creek with a residential town at its mouth, depending on the creek for its water supply. A second valley in watershed B is owned in its entirety by a group of industries which are planning to build factories which would have highly offensive industrial waste effluents. This valley leads down to a wild uninhabited stretch of ocean beach where the currents are such that the water coming from the valley will be carried out to deep sea. With the waters of Nowhere Creek in the natural state and at the low flow volume at the site of each proposed industry, no single one of those proposed industries would, by its industrial waste discharge, render the waters unfit for human consumption; unsuited for industrial use, or recreation; or harmful to aquatic life or growth. Yet if all were operating and discharging industrial wastes into the watershed, the waters would be rendered unfit and harmful.

All of the industries can prove that their products are essential to the general welfare. All operate in accordance with the widespread assumption that essential industry has the right to use the flowing waters of the region as a means of carrying away the waste from the industry.

In brief this is the factual situation. A conglomeration of industries, by their independent actions of discharging industrial wastes, have destroyed a public water supply and imposed hardships on individual riparian owners, and have closed an important stream for recreational use. Similar industries plan to create exactly similar conditions on a presently clean stream. A third group of industries, which may be competitive with those on the other streams, own an entire valley so situated that industrial wastes discharged into its waters can appear to harm no one.

### Possible Common Law Remedies

Since it is now the public assumption that water in our lakes and streams, and underground, is a natural resource which must be conserved and used but not abused, it is clear that the situation described requires remedial action. What is the possibility of remedial action through the common law? In considering that question it is essential to understand some legal terms and principles.

The mines and the other industries and the individual property owners have legal title to their lands. As the holders of legal title they have certain property rights. That means that, as regards the lands to which they have legal title, they have certain legally enforceable claims against others that those others shall do or not do certain acts. Those others, the outsiders, owe duties to the holder of the land title. That is, they are under a legally enforceable obligation to do or not to do certain acts. For instance the owners have the property right to carry on legitimate business enterprises on their lands. They have the property right to mine and sell and ship away their coal. They have a property right in the oil and gas and clay and limestone in, on or under their lands, with the right to remove it and sell it. They have the property right to use the natural slope of their land and the natural watercourses to drain away the water naturally flowing or falling on their lands. They have a property right to make certain

*Presented at the Sixth Industrial Waste Conference, Purdue University, and published here by permission.

limited use of the waters flowing through or along their lands. They have a property right that waters of the flowing streams on which they are riparian owners reach their lands without substantial diminution in quantity and unimpaired in quality.

Some of the correlative duties, "or legally enforceable obligations," which others owe to the land owners may be briefly noted. Others have the duty of refraining from trespassing on the owners' lands. Legal processes are available to prevent or punish the taking away of trees, coal, oil, produce. Adjoining property owners can be prevented from blocking natural drainage channels so that water is backed up on the lands of others. Upper riparian owners have the duty of allowing the waters of the streams to reach those below practically undiminished in quantity and unimpaired in quality.

In some states—Pennsylvania is an example—it has been held that where a lower riparian owner suffers loss through stream pollution traceable to the non-negligent and necessary operation of a great or essential industry, the industry has the legal privilege of continuing the pollution. This applies only where the sufferer is an individual and not to the general public. A legal privilege is a mere freedom from legal restraint and is not a property right. However, the early Pennsylvania decision and the common desire of communities to have mining and industrial enterprises encouraged had the natural result of continued, expanding and growing tolerance of industrial stream pollution. Since means of having both industry and clean streams had not been found and since unspoiled streams were for many years relatively easy to reach, little attention was paid to the pollution. So far as the writer has been able to learn there has been no case where the highest court of a state has held that any industry or property owner had a property right (not founded on an express grant) to pollute any stream. Such pollution is what is called an intentional non-trespassory invasion of the property of others and, under common law, will not be restrained, nor punished by assessment of damages, if the gravity of the harm is outweighed by the utility of the pollutor's conduct. This is a modern statement of the principle involved in the old Pennsylvania case of *Sanderson v. The Pennsylvania Coal Company, 113 Pa. 126.* To repeat: the pollutor may have a privilege, but that is not a property right and is good against individuals but not against the public.

Another legal principle is that even wrongdoers are entitled to their day in court. One accused has the legal right to have the matter passed on by a court of competent jurisdiction which will consider evidence and render a decision. This is sometimes called due process of law. It is necessary for the state or a plaintiff to produce evidence which will stand up under skilled cross examination and which will be convincing to a jury or the court.

Another legal principle is that conduct which annoys, inconveniences, troubles or endangers the whole community in general and not merely some particular person is an offense against the state and is a public nuisance. Technically the conduct which creates the condition is a public nuisance, but the condition resulting from the offensive conduct is often spoken of as a public nuisance.

Bearing in mind the legal principles concerning property rights and duties; concerning privileges and non-trespassory invasion and the weighing of utility conduct against the gravity of harm; concerning due process of law and the need of convincing evidence; and concerning public nuisance; we must find whether the common law, without new legislation, could correct the evils in the hypothetical situation described.

As regards the individual riparian property owners whose enjoyment of the streams has been interfered with, they probably could get no relief if they asked for damages or sought an injunction to restrain any one or all of the industries. They would certainly be met with difficulties of proof as to causes and sources of the pollution and would certainly have difficulty because of the doctrine of privileged conduct and the need for weighing harm against the admitted public interest in having the industry or industries continue to operate.

On Somewhere Creek a public nuisance is present and a public nuisance is threatened on Nowhere Creek. The practical destruction of a public water supply is universally considered a public nuisance. A substantial worsening of the quality of water supplied to the public even though the water remains safe is still a public nuisance. Under the assumed facts of this case no individual industry, considered alone, could properly be found to have been guilty of a public nuisance. An equity proceeding naming all the industries as defendants and seeking an injunction to restrain all and each one from permitting industrial waste to flow into the streams might possibly be successful. The case would be extremely difficult, involving exhaustive and exhausting study, investigation and testimony in order to show the part that each industry played in the final pollution. On Nowhere Creek an effort to restrain the building of the proposed plants would be practically hopeless. The only evidence which could be presented would be based on theories and assumptions which would be extremely difficult to make convincing to the court.

As a practical matter it appears that the common law, unaided by new legislation, offers no worthwhile prospect of relief for the people of these valleys.

### Police Power Legislation

What can be done through legislation in conjunction with the common law? Such legislation would be enacted under the police power of the state. Police power legislation must be interpreted and enforced by the courts in the light of fundamental legal principles.

First, valid police power legislation does not take away basic property rights, so that the rights and duties relating to property rights discussed heretofore must be kept in mind. It is an inalienable right of a state to exercise its police power and it is the duty of the state to exercise it to protect and advance the health, safety and general welfare of its people. An exercise of the police power may lessen the value of property and of property rights by restricting the manner of using property. The police power may take away—for the good of the general public—a legal privilege enjoyed as against individuals. The state by police power legislation may decree that public welfare has tipped the scales against the continuance of a privileged stream pollution. Since police power legislation which is valid does not take away property rights, it differs from eminent domain in that, in principle, no compensation need be paid by the state.

Second, police power legislation to be valid must not deny due process of law and must not deny to anyone the equal protection of the law.

Third, valid police power legislation must be such as to show some clear, real and substantial connection between the assumed purpose and the actual provisions, and those provisions must in some plain, appreciable and appropriate manner tend toward the accomplishment of the object for which the police power is exercised.

Fourth, police power legislation may be valid which prohibits acts which are innocent or innocuous in themselves if such prohibition is necessary to secure an efficient en-

forcement of otherwise valid police regulations, and police power legislation is not limited to the suppression of matters which are offensive or which constitute nuisances.

If those fundamental legal principles are kept in mind by the legislature, laws can be enacted which will be found valid by the courts and which will protect and advance all legitimate interests. The drafting of such legislation will require skilled draftsmen having cooperation from chemists, sanitary engineers and biologists.

In practice it cannot be enacted into law or enforced afterward unless it is understood, appreciated and approved by the men of good will and sound understanding in industry and in the community. It will certainly not be approved or relished by all men in industry and attempts will be made by some to get around it or to violate it without discovery or punishment. However, such laws are usually made to prevent and punish abuses and to protect those suffering from abuse or who wish to conduct their affairs so as not to injure others. The latter need protection from the unfair competition of the backward or wayward.

### General Scheme for Police Power Legislation

What should be the general scheme of such police power legislation to correct the conditions assumed? This general scheme can be presented without presenting a detailed draft which would require weeks of study and consultation. A very promising draft has been published by the Federal Security Agency, Public Health Service, Division of Water Pollution Control, in the form of a Suggested State Water Pollution Control Act. That draft meets most of the essential needs but may have a few loopholes which might cause trouble.

In order to meet anticipated—and experienced—difficulties of proof of violation, it is suggested that the terms "sewage," "industrial waste," "pollution" and "pollute" should be so broadly defined as to catch all conceivable contributing factors leading to stream degradation. The emphasis should be on acts or omissions rather than on the results of such acts or omissions. The definitions should ignore such factors as stream flow volume, dilution, and self-purification of flowing water. Such broad definitions could catch the case of a new industry which would put a relatively low amount of contamination in the stream to no one's injury but where intolerable conditions would be created if others did likewise. It should be broad enough to catch the newly opened strip mine before the effluent becomes acid through exposure of the contaminating chemicals to air and water over a period of a year or more.

Next, there should be a flat prohibition on all against allowing sewage or industrial waste, as broadly defined, to reach the streams, lakes or underground waters of the state without a permit from some regulatory body.

With the permit system the regulatory bodies should be empowered, under statutory standards, to classify the streams of the state so that clean streams could be kept clean and polluted streams gradually cleared. Where corrective measures are possible, permits should require that those measures be taken. In order to bring about an ultimate clean stream situation and in order to prevent unfair competition which might involve charges of failure of affording the equal protection of the laws, permits for continued pollution of already polluted streams should be limited in time and should carry some compensating financial burden on the holder of the permit to help the state carry on research in treatment of industrial wastes. Such a burden would lead the backward to correct bad practices. Clean stream permits would be issued only where completely satisfactory corrective or control measures were to be carried out. The legislation should be so drawn and all permits should be so worded that no one could claim a property right or a vested interest in even the limited privilege of discharging even completely treated sewage or waste into the waters of the state. Advancing knowledge or changing conditions might make a permit issued this year obsolete in a few years.

The purpose is to protect and advance the health, safety and general welfare by protecting the waters of the state. The suggested statute would show a clear connection between that purpose and its actual provisions. The provisions would tend in a plain and appropriate manner to accomplish the desired end.

### Conclusion

We must all understand that no industry or community has a property right, or any right, against the expressed wish of the state, to pollute the waters of the state. As against the state, such pollution in the past may have been overlooked, condoned perhaps, but never approved. We are all interested in an advancing, growing, but improving industrial economy. We all know now that we cannot afford to dissipate our limited water resources by utilizing our streams as mere carriers of filth. We have faith in the skill, wisdom and public spirit of business men as a class, but we know that pressure must be put on some. Such pressure is best exerted through sound legislation.

## "Jo" Randlette is Dead

A water works "Super," with many facets and abilities.

JOSEPH W. RANDLETTE, Superintendent and Treasurer of the Water Works of Richmond, Maine, died on April 22, 1951, after a long illness.

He was born in Richmond on March 9, 1874, and was educated in the schools of that town and in the University of Maine, being graduated in 1896 with the degree of BME.

While at the University of Maine, he was active in athletics and other interests, including glee club and dramatic club and was a member of Kappa Sigma.

Following graduation, he was employed by the New England Telephone & Telegraph Co. in various capacities and became connected with the Richmond Water Works in July, 1908, as Superintendent, which position he held at his death.

Mr. Randlette was one of the charter members of the Maine Water Utilities Association, held many offices, and was chairman or member of most of the active committees of the Association at one time or another.

His service to his community was varied and widespread, he having been Chief of the Fire Department, town clerk, county commissioner and trial justice.

Surviving "Jo" Randlette are his widow and one son.

### Firsts

According to Purdue's *Sanitary Engineering News*, the first trickling filter type sewage treatment plant in America was that of Madison, Wis. (1901) and the first activated sludge plant was that at San Marcos, Texas, in 1916.

Patapsco River Pumping Station—Left, Front; Right, Rear.

# Patapsco Interceptor Sewer and Pump Station

*by* WILLIAM F. NEALE, *Chief Engineer*
*Baltimore County Metropolitan District, Towson, Md.*

A PROJECT of considerable interest is now nearing completion along the banks of the Patapsco River in Baltimore County, Maryland. This work is being done under the direction of the Baltimore County Metropolitan District through the Department of Public Works and is unique in the difficult construction conditions encountered requiring unusual construction procedures in addition to the development of a flexible water-tight joint for large size concrete pipe.

The Patapsco interceptor system now being constructed will connect the Herbert Run outfall sewer presently discharging approximately 2.5 million gallons of raw sewage per day in the river. This sewage is from the densely populated communities of Catonsville, Arbutus and Halethorpe, lying to the north of the Patapsco River. In addition the interceptor sewer will furnish an outlet for much needed lateral sewers in the communities of Lansdowne, English Consul, and Baltimore Highlands. These laterals are currently being constructed or under contract at a total cost of $1,080,500.00. (See Map, Fig. 1)

Since the magnitude of the overall interceptor and pump station project precluded the possibility of one contractor making the complete installation, a division of four separate contracts was made. The construction costs shown for these contracts are based on the actual bid plus a percentage amount for office overhead and engineering contingencies.

| | | |
|---|---|---|
| 1. | Sewage Pumping Station | $457,900.00 |
| 2. | Force Main, 8650 ft.—30 in. Enameled Steel Wrapped Pipe, Approximately $35.50 per foot | 307,500.00 |
| 3. | Gravity Sewer, 7050 ft.—42 in. Vitrified Clay Lined Concrete Pipe RCCPX, Approximately $43.50 per foot | 306,500.00 |
| 4. | Gravity Sewer, 7180 ft.—48 in. Vitrified Clay Lined Concrete Pipe RCCPX, Approximately $48.50 per foot | 348,700.00 |
| | Total Cost of Project | $1,420,600.00 |

## Gravity Sewer

The gravity sewer line parallels the Patapsco River for a considerable distance at a depth below mean low tide and through a very unstable soil of an alluvial nature. With these conditions in mind the engineering consultant, William A. Goff, Inc., of Philadelphia, first recommended cast iron pipe. However, subsequent soil bearing tests indicated that pile bent supports would be required to maintain grade and alignment of the cast iron pipe in such unstable soil. It was then determined at a joint meeting with the consultant to use vitrified lined reinforced concrete pipe of the following specifications.

### Sanitary Sewer Pipe

(a) *Vitrified Lined, Reinforced Concrete Pipe:* Fully lined (360 degree) precast reinforced concrete pipe shall conform in thickness, reinforcement, curing and strength to "Standard Specifications for Reinforced Concrete Culvert Pipe", A.S.T.M. Designation C 76-41, Table 11. It shall have two lines of circular reinforcement and a nominal laying length of not less than twelve (12) feet.

Each length of pipe shall be provided with smooth surfaced, tongue and groove ends, with annular space accurately formed and not more than ⅛ in. and not varying more than 1/32 in. plus or minus and shaped to receive rubber compound, compressive gaskets. The joint surfaces shall be concentric and of such dimension and shape that the joints shall be self-centering when the pipes are laid. The joints shall be sealed with continuous ring rubber compound gaskets, providing a series of contact surfaces in such a way that the joint shall remain tight under all conditions of service, including expansion, contraction and normal settlement.

Vitreous liner plates shall be salt glazed vitrified clay plates, installed in the full circle of the pipe, and in accordance with Standard Specifications, A.S.T.M. Designation C 13-41 for burned shale de-aired, special acid resisting, with an approximate width of 9¼ inches and length of 24 inches with proper curvature to suit the pipe diameter.

Liner plates shall be fastened to the inner mold with sufficient steel bands to hold the liner plates correctly and firmly in place and a space between the plates to be provided with rubber strips to form slits not to exceed 3/16 in. in thickness. When the forms are stripped, the rubber strips between the liner plates shall be removed and the pipes carefully cured and aged. At a subsequent date, before filling the slit spaces between liner plates, they shall be given two coats of Rexon Coat No. 2, applied to all exposed concrete between the plates. These spaces shall then be filled to full depth with Durisite Cement, Basolit, or approved equal acid-alkali proof cement. After pipes are installed the joint between the liner plates of each pipe shall be filled to full depth with the resinous cement.

This pipe shall be referred to as "V.C. Lined RCCPX" and all materials, processes of manufacture and the finished pipe shall be subject to inspection and approval by the Engineer.

(b) *Gaskets for V. C. Lined RCCPX:* Rubber composition compression type gaskets shall be provided for all V. C. lined RCCPX sewer pipe joints. They shall con-

sist of a series of pyramid rolls or fins, tied together with a center web forming a continuous band of diameter to neatly snap into position on the tongue of the pipe. The gaskets shall be Type "A" Tylox joint gasket as manufactured by the Hamilton Kent Manufacturing Co., or approved equal. A lubricating cement shall be furnished with the gasket for holding the gaskets to the tongue and to seal it to the groove of the pipe. Joint assembly shall be made in accordance with the recommendations of the gasket manufacturer.

(c) *Resinous Cement for V. C. Lined RCCPX:* To seal the internal joints between the V. C. lined RCCPX pipes, there shall be used an acid-alkali resinous cement. It shall be "Nuken All Purpose" resinous cement, or approved equal and applied in accordance with the manufactuerer's recommendations.

### Timber and Stone Foundation

As a further precaution against the unstable soil conditions, the consultant specified a foundation of gravel and timber planking for the gravity sewer line as follows:

(a) The 42 and 48 in. shall be laid, unless otherwise directed by the Engineer, on a carefully prepared timber planking and crusher run stone or gravel foundation formed between continuous side sheeting, as shown on the drawings. The side sheeting shall be set to provide two feet of clear working space on each side of the proposed pipe line, and driven to a depth of not less than three feet below the top of the gravel bed. Excavation shall be carried to such depth as will provide for the two-foot thick gravel bed, four-inch planking thickness and the necessary blocking under the pipe. The gravel fill shall have a compacted thickness of not less than two feet, and shall extend from inside to inside faces of sheeting. The timber planking shall be constructed of two layers of two-inch thick planks. The first layer shall be laid longitudinally and the second layer transversely to the long axis of the trench, to fully distribute the pipe load to the gravel bed.

The first section of gravity sewer to be constructed was the 42 in. main. This work was done by the Utilities Construction Co. of Lutherville, Md., who set up their own manufacturing plant for the concrete pipe used in the installation. (See accompanying photographs.)

Some difficulty was encountered in obtaining a tight joint due to the cold mastic joint preparation not holding. A hot mastic applied through gate openings drilled in the pipe bell directly over the joint remedied this condition.

The 48 in. concrete pipe installed by Leo Butler Co. of College Park, Md., was so designed to take advantage of previous experience with the 42 in. installation. Provision was made to cast the pouring gate for the hot mastic preparation as part of the pipe mold. In addition the bell and spigot was offset and asphalt belting was used to seal the outer joint. (See Detail, Fig. 2) The asphalt belting is caulked in place with regular lead caulking tools and has the advantage over a mastic joint in that it can be recaulked should a leak develop.

The contractor installing the 48 in. sewer has shown ingenuity in first making a road bed of bank run gravel on a timber mat along the river bank otherwise impassable to heavy equipment over which the concrete pipe sections are transported and positioned for laying. As the pipe is laid, the road bed is excavated and used as a foundation in accordance with the specifications. See Figure 3.

### Pump Station

The sewage pumping station now being built by Square Construction Co. of Baltimore, Md., will pump all sewage collected and conducted to this point by the previously described gravity interceptor sewer through an overland force main and discharge into the existing 27 in. V. C. sewer at the Baltimore City line. The capacity of the 27 in. sewer which in turn discharges into a 24 in. sewer has been figured of approximately 10.2 mgd. The 24 in. sewer has an estimated capacity of 7.8 mgd. Therefore it is planned to limit the rate of pumping to not more than 6000 gallons per minute with a preferable operating figure of 4000 gallons per minute until such time as the City of Baltimore can increase the capacity of their receiving sewer.

The pumping station will be constructed with reinforced concrete substructure and brick masonry superstructure. The ground or main operating floor will be accessible from Old Annapolis Road and at such elevation as to be several feet above the highest

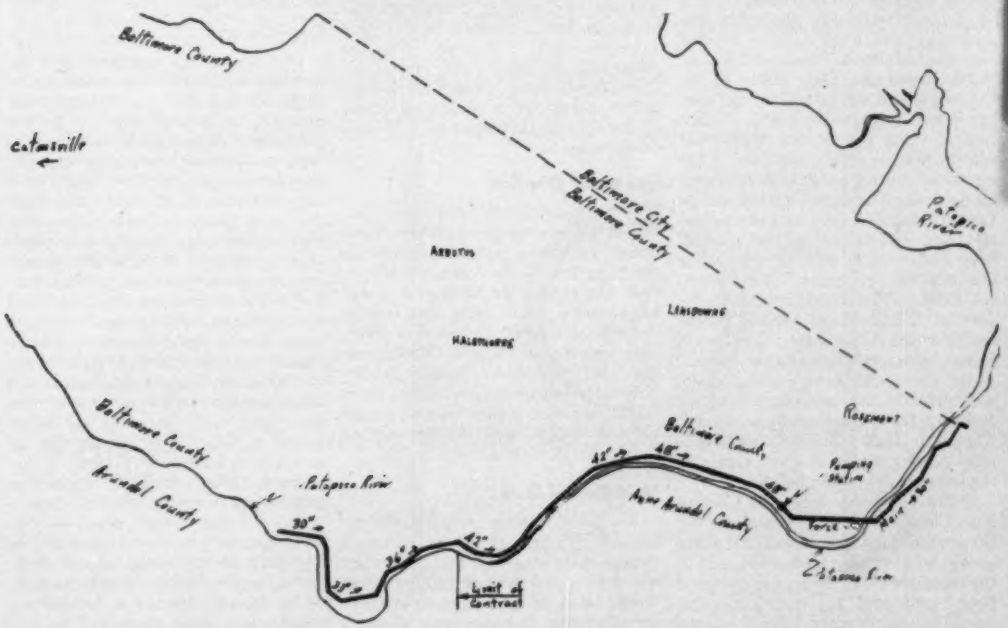
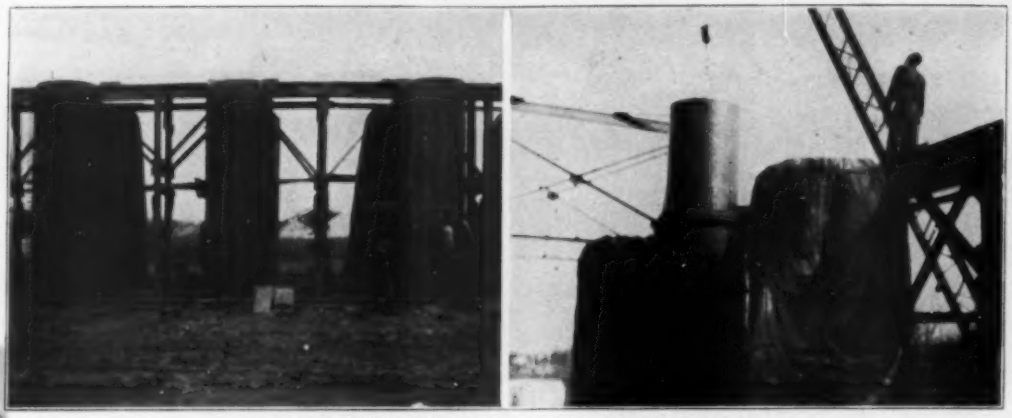



Fig. 1—Map Showing Location of Interceptor, Pumping Station and Force Main and Area Served.



On the Job Manufacturing Plant for Reinforced Concrete Pipe
*(Note Reinforcing)* *(Curing 42-in. pipe)*

flood level of record. The intermediate floor will be approximately at the lower ground elevation but without outside opening owing to the high flood elevation possible. The lowest floor will be quite deep in the ground to allow sufficient depth in the suction wells below the flow line of the intercepting sewer. The structure will be of functional design with the superstructure in a conservative colonial brick and limestone style, well suited to harmonize with the rural setting, with possibilities of being ultimately developed as a park area.

The main or control floor, housed by the superstructure above the entrance ground level will be divided into Control Room, Electrical Room, Wash Room and Stair Hall. In the Control Room will be located the sewage pump motors, the pump suction control valve stands, the multi-point control float switches, the face of the electrical control panel and the operator's desk. The pump motors will be vertical mounted type on floor pedestals and will be served by a small overhead monorail with hand hoist for dismounting or repairs. The Electrical Room will provide access to the rear of the electrical control panels and flow measuring meter. The Wash Room, equipped with shower, urinal, water closet, lavoratory and lockers will provide the necessary sanitary facilities for the operating personnel. The Stair Hall containing an aluminum grating staircase gives access to the lower floors of the building.

A rear doorway from the Control Room leads out into a deck above the Screening Room for access to hatches above the screening mechanism and to the main control gate motor operated floor stand and the overflow valve operating stand, more fully described hereinafter.

## Scheme of Operation

Sewage will enter the pumping station structure from the last manhole of the proposed gravity intercepting sewer through a main control sluice gate located in the screening room.

The raw sewage will be shredded into small particles by either or both electrically driven comminutors flanking a manual bar screen, which would serve as an alternate standby. From the comminutors the shredded sewage will flow to two circular frustrum bottomed suction wells from which vertical non-clog raw sewage pumps will take their suction. The pumps will discharge into a common header pipe equipped with a Venturi tube for measuring the total pump discharge. From the discharge header the sewage will be conducted to within the limits of the City of Baltimore by a 30-inch force main.

## Emergency Overflow

In the case of prolonged power failure or other emergency, when it becomes necessary to shut down the pumping station by automatically or manually closing the main gate, it will be possible to by-pass the sewage through an overflow valve and diversion pipe to the Patapsco River near the Old Annapolis Road Bridge. Normally the overflow valve will be sealed in a closed position and should only be opened with due consent of the State Department of health.

## Main Control Gate

To guard against flooding the interior of the Sewage Pumping Station during flood stages of the river when infiltration into the intercepting sewer would be at its maximum or at times of otherwise extreme peak flows, a 48-inch automatic and/or manually controlled sluice gate will be located at the sewer entrance to the station. When the sewage pumps approach their capacity steps or the pumping capacity nears that of the temporary receiving sewer in the City of Baltimore, this gate will automatically start to close thereby restricting the incoming sewage flow. As the station or sewer capacity is more nearly reached, the gate will be further closed until the inflow does not exceed the required capacity. Manual operation of the gate will be possible from the deck above the screening room portion of the building.

## Comminutors

The shredding machines will be normally in constant operation, either singly or together depending on the quantity of sewage flowing to the pumping station. Each machine will have a normal operating capacity ranging between 1.0 to 9.0 mgd. with ability to each handle up to 10.5 mgd. for peak surges. Combination stop and straight edge opening weir plates in the effluent channels will permit proper submergence of the comminutor drums to develop the capacity of the machines. For several years to come one machine should be able to handle the entire sewage flow except for possible peak flows, while the other machine will be a standby unit. Ultimately both machines will be required at which time the manual bar screen may have to be utilized to supplement the machine capacities. Screenings thus manually collected by the bar screen would be allowed to drain on the perforated plate and be fed back to the sewage ahead of the communitors during off peak periods. Flow to and from the comminutor chambers will be controlled by stop and weir plates, operable by a hoist

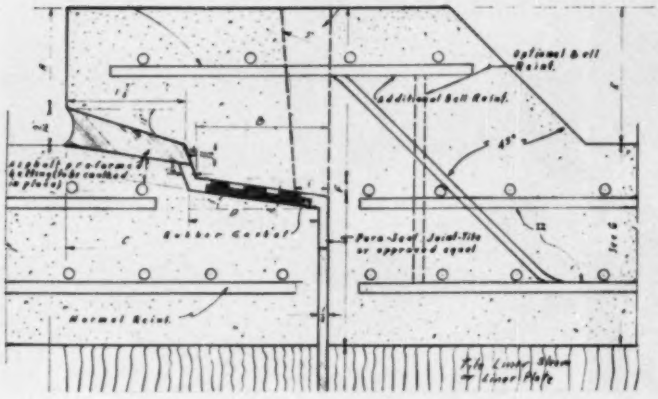



Fig. 2—Details of Concrete Pipe Joint Design.

suspended on a swinging jib crane type monorail near the ceiling of the Screening Room. The renewal of teeth and combs on the comminutors can be done by entering the machine channels or the machine itself can be hoisted to the deck by the overhead hoist.

### Suction Wells

The two 18-foot diameter circular suction wells will each have a normal working water depth of 7½ feet between high and low water. The hopper bottoms from the low water level down to the bottom will be in the shape of an inverted frustrum. Twenty-four-inch cast iron pipes will extend from each well to a suction header in the adjacent pump room. Mud valves located at the top of each suction riser tee will provide means of taking into the suction any scum or other floating matter collected in the wells, by drawing down the liquid level to that of the mud valves. Stop plates inserted in the influent weir plate grooves and shutting of the effluent valve will take either of the suction wells out of service for cleaning or other purposes. Approximately half of the top of the wells will be open for observation of the nature and volume of the contents. The normal working water depth has been divided into several pumping step levels, as more fully described hereinafter.

### Pumping Equipment

It is proposed to provide for four vertical, non-clog raw sewage pumps to lift the sewage from the suction wells and discharge the same through the force main to the sewers of the City of Baltimore. The pumps will be located on the lowest floor of the pumping station with long vertical shafts running in intermediate bearings, extended through the intermediate floor to the electric drive motors located well above flood level on the ground floor. Suction to all pumps will be taken from the previously described valved 24-inch cast-iron pipe header and discharge will be made to the 14-inch to 30-inch cast iron pipe discharge header containing the venturi flow measuring tube, through individual discharge gate and check valves.

The pumping equipment must be designed to meet two widely different conditions; namely, (1) relatively low initial sewage flows with force main discharging at a low elevation a distance of approximately 9,000 feet from the station and (2) high ultimate sewage flows with force main discharging at a relatively higher elevation at a distance of approximately 5,500 feet further away from the pumping station. Accordingly pumping equipment suited to meet the present conditions will be limited in delivery capacity in the future due to the higher static and friction head requirements of the future. As far as practical, pumps have been selected to be usable under both conditions by the use of two speed motors and various combinations of operation, which take advantage of favorable suction heads when discharge heads are less favorable.

Another restriction of considerable bearing is the size of the temporary receiving sewer in the City of Baltimore. The vitrified clay sewer terminates in a 27-inch diameter size but downstream flow into a 24-inch sewer. Accordingly the pumping capacity must be limited at present to such amount as will not overload this existing sewer. Ultimately when the force main is extended to the more distant point of discharge, pumping capacity can be increased to develop the full capacity of the pumping station.

Accordingly the following pumps have been selected for present installation, one space being allocated for future:

*Capacity at Various Speeds*

| Pump No. | From GPM | From RPM | To GPM | To RPM |
|---|---|---|---|---|
| 1 | 2,000 | 497 | 4,000 | 695 |
| 2 | 6,000 | 430 | 8,000 | 497 |
| 3 | Space and connections for future installations | | | |
| 4 | 2,000 | 497 | 4,000 | 695 |

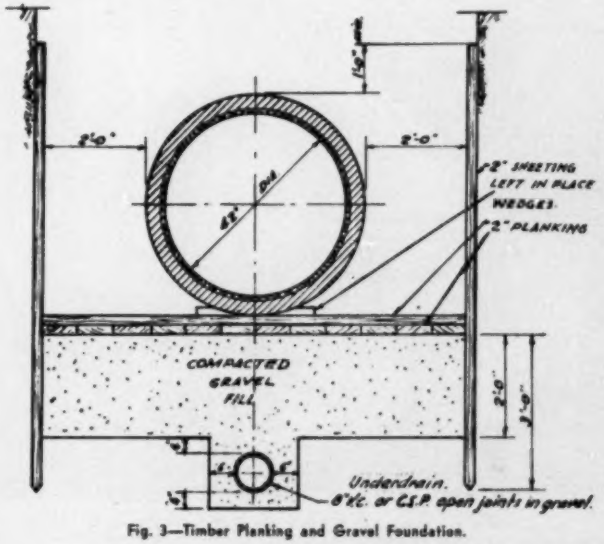
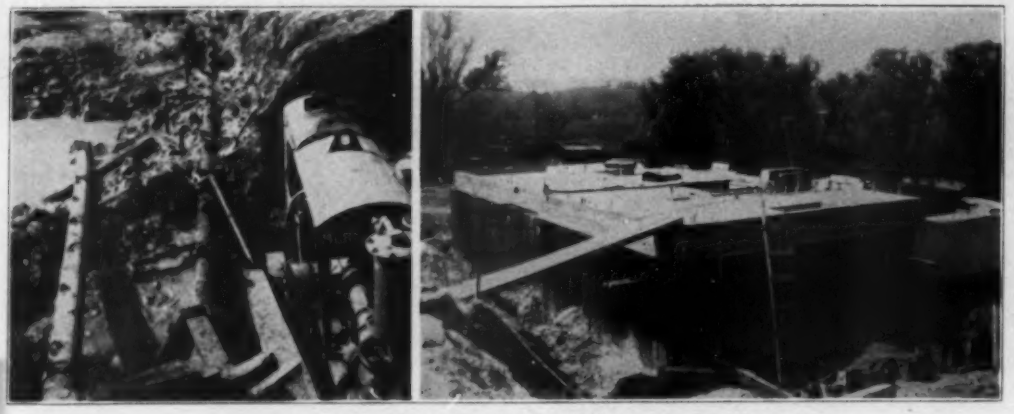



Fig. 3—Timber Planking and Gravel Foundation.



**Patapsco River Pumping Station**
*Left—May 4, 1949, Note Moretrench Well Points; Right—May 29, 1950*

Table 1
PUMPING SEQUENCE

| Pump Step | Pump No. | Size | Speed | Capacity | Approximate Horse Power |
|---|---|---|---|---|---|
| No. 1 | #1 or #4 | 8" | 497 rpm. | 2,000 gpm. | 16.5 |
| 2 | #1 or #4 | 8" | 695 " | 4,000 " | 33 |
| 3 | #2 | 12" | 430 " | 6,000 " * | 73 |
| 4 | #1 and #4 | 8" | 695 " | 7,000 " ** | 51 each |
| 5 | #3 | 12" | 695 " | 8,000 " | 115 |
| 6 | Partial closing of main control gate | | | | |
| 6 | Alarm and further closing of main gate | | | | |

* Capacity of the receiving 24" V. C. Sewer in Baltimore
** Capacity of the receiving 27" V. C. Sewer in Baltimore

These three pumps would provide an initial pumping sequence in accordance with Table 1.

For later installation Pump No. 3 with the following general characteristics would be added, and Pump No. 4 will be replaced with a larger unit as follows:

*Capacity at Various Speeds*

| | |
|---|---|
| Pump No. 3 | 9,000 gpm. at 388 rpm. |
| Pump No. 4 | 12,000 gpm. at 430 rpm. |

The then existing pumps would lose capacity due to working under higher heads created by the installation of the longer force main to the higher point of discharge giving the approximate pumping sequence shown in Table 2.

The pumps will be operable either under complete automatic or manual electrical control. Automatic pilot devices will consist of two multi-point float switches operated by the rise and fall of the liquid in the two float wells which in turn respond to the rise and fall of the sewage in the two suction wells. A small stream of fresh water from the secondary water pressure system will be introduced into the top of the float wells to retard accumulation of solid matter therein. No direct physical connection will be made between the city fresh water supply and the float wells as the water will come from a separate system as more fully described hereinafter.

### Surge Tank

To suppress the back pressure from the force main when the pumps shut down a surge tank is proposed to be connected to the 30-inch riser pipe between the pump discharge header and the force main. This tank with an air cushion at the head will have a volume of approximately 119 cubic feet and external dimensions of four feet diameter by 9½ feet high. This tank will be mounted vertically, equipped with control and check valves drain valve, relief valve, water level gauge, manhole and air connection. A small automatic air compressor and receiver will be provided to maintain an adequate air residue in the surge tank.

Table 2
PUMPING SEQUENCE

| Pump Step | Pump No. | Size | Speed | Capacity | Approx. hp. |
|---|---|---|---|---|---|
| No. 1 | #1 | 8 in. | 695 rpm. | 3,200 gpm. | 50.5 |
| 2 | #2 | 12 " | 430 " | 4,000 " | 64 |
| 3 | #2 | 12 " | 695 " | 7,500 " | 115 |
| 4 | #3 | 14 " | 388 " | 9,000 " | 163 |
| 5 | #4 | 14 " | 430 " | 12,000 " | 317 |
| 6 | Partial closing of main control gate. | | | | |
| 7 | Alarm and further closing of main gate. | | | | |

### Venturi Tube and Meter

There will be located between the 30-inch diameter pump discharge header pipe and the force main a flow measuring venturi tube, with a 30-inch inlet and outlet and a 15-inch throat, having a laying length of approximately 20 feet. The tube will have a measuring range of between 1.85 and 18.5 m.g.d. It will be equipped with pressure cleanout openings and removable covers for cleaning and inspection. In connection with the tube there will be a pair of continuous flushing connections from the secondary water pressure system for flushing the vent chambers.

Located on the main electrical control panel will be a Register-Indicator-Recorder instrument to indicate the momentary rate of flow, to totalize the total number of gallons of sewage passed and to record the rate of flow of the sewage continuously on 24-hour charts. The instrument will be electrically actuated by electrical impulses from an electrical transmitter located below the venturi tube.

This measuring tube and meter will provide a record of flow, based on which payment will be made by Baltimore County Metropolitan District to the City of Batlimore for the treating of the sewage collected by the proposed intercepting sewer.

### Miscellaneous Equipment

The building will be heated by an automatic oil-fired hot water heating system utilizing cast iron direct radiation on the control floor and unit heaters in the basement areas. Fuel

will be supplied from an exterior oil storage tank and temperatures will be controlled thermostatically.

A small air compressor and receiver will be provided for maintaining the proper air head on the surge tank as previously described. Monorails, with hand type hoists, will be provided to lift motors, control stop and weir plates and other pieces of equipment. Hoisting rings will be provided to assist in the raising or lowering of equipment into or out of the basements of the buildings.

A system of forced venitlation consisting of a ventilation fan and ductwork will provide ventilation in the basement, sub-basement area of the building. Duct dampers will permit adjustment of suction to suit building conditions. The exhaust air will be discharged through a flue provided in the masonry chimney to above the roof line.

Complete power and light controls will be modern cubical dead front type with automatic and manual operation facilities for all electrical equipment. Power will be supplied as 3 phase, 2300 volt current and transformed down to 440 volts for entrance to and use in the building. The principal equipment will be operated on 440 volts while the smaller equipment motors such as fan, oil, burner, etc., would run from the lighting circuits.

A sump pump with automatic float control will be provided in the sump in the Pump Room to pump any seepage or drainage up into the suction wells. The sump will also serve as a flow-off point for the two multi-point switch float wells. In the event of serious emergency flooding of this room beyond the point where the sump pump can handle the quantity, it will be possible to take suction from the sump by any of the sewage pumps through an auxiliary suction connection thereto. The valves for this operation will be operable from the intermediate floor level.

A secondary water pressure system will also be provided to take water from the City water supply without a definite cross connection and place it under pressure for use in the Pumping Station where contact with flowing sewage would otherwise allow contamination of the City supply. The system will consist of a small loose covered receiving tank with City water supply connection above the rim level, controlled by a float valve and provided with an overflow. From this tank a plunger type piston pump will take suction and pump the water to the pneumatic storage tank operating under 75 pounds maximum pressure. The pump will have a capacity of 750 gal. per hr. and will be under automatic pressure switch control. The pneumatic tank with capacity of 120 gallons will put an air head on the system and serve as a storage tank. The discharge will be piped to the venturi-tube, air release valves, and the two float wells for flushing and to the sewage pump stuffing boxes for sealing purposes. Solenoid valves in the pump stuffing box seal lines will allow flow to same only when pumps are in operation.

## Force Main

The force main will carry sewage from the pumping station overland to and under the Patapsco River, thence overland in Anne Arundel County to Riverside Road in the Brooklyn section at Baltimore City line where for the present it will discharge into an existing 27 in. V.C. sanitary sewer. This connection point is of a temporary nature according to an agreement with City of Baltimore to extend the force main further into the City to Frankfurst St. at some future date dictated by increased capacity requirements.

A considerable portion of the route traversed by the force main is swamp land inundated most of the year and subject to tidal fluctuations. For this reason it was determined to use 50 ft. lengths of 30 in. steel pipe coal tar enamel lined and coated with an outside double wrapping of asbestos felt,

*(Under B & A RR.)*

*(Through Swamp)*

**Laying the 30-inch Force Main**

Since the pipe cannot be positioned along the line of construction, it must be moved over water from the stock pile to the point of installation. The contractor has set up a stiff-leg derrick type of rotary crane to lower the pipe from the stock pile to water level where it is floated into place, the open ends having been previously made water tight. A bulkhead is constructed at the point of joining the pipe section to the portion of force main already installed. The water is then pumped from the bulkhead and the joint made with Style 38 Dresser couplings following which a protective coating is applied. The pipe is supported on wood pile bents at 25 ft. spacing in a trench previously excavated by blasting in much the same way as an irrigation ditch is blasted. (See photos)

With the completion of this project, sanitary sewer service will have been made available to a major portion of the Southwestern Section of Baltimore County totalling in all approximately 14,000 acres. Lateral sewer systems will be extended upon request to the various communities in the drainage area served by the interceptor as these communities become sufficiently developed to make the installation financially feasible.

We wish to make acknowledgement and express our appreciation to the following people for their assistance and guidance in the planning and construction phases of the project:

Nathan L. Smith, Chief Engineer of the Department of Public Works
George W. Welsh, Superintendent of Construction for the Metropolitan District

Dan R. Smith, Associate Engineer, assisted in the preparation of this report. Construction pictures are by Robert Wareheim, Inspector-in-Charge of the project.

## "Dave" Moulton Passes

Was father of Maine Water Utilities Association, which he served as President for twenty-five years.

DAVID EDWARD MOULTON, President of the Maine Water Utilities Association from its organization in September, 1925 to October, 1950 died April 21, 1951, suddenly, in his sleep.

"Dave," as he was affectionately known, was born in Falmouth, Maine, on September 16, 1871, coming from old New England Colonial stock.

He received his early education in the public schools, and while working at the carpenter's trade, he fitted himself for entry to Westbrook Seminary, where he graduated in 1888.

Choosing the profession of law, he entered Yale Law School and was graduated therefrom with the degree of L.L.B. in 1897, and received the degree of M.L. the year following.

In 1899 he came to South Portland to practice law and became the first City Solicitor of South Portland, serving from 1899 to 1907.

In 1908 he began to practice law in Portland, specializing in corporation and public utility law and became widely known for his valuable services to the Portland Water District. He was the oldest employee of the P. W. D., having served for forty-three years and ten months as attorney.

He was very active in the utility field and was one of the prime movers and original incorporators of the Maine Water Utilities Association, of which he was president from the beginning and for a twenty-five year period until October, 1950.

A series of learned discussions on "Water Works Law," written by "Dave" Moulton and published by the Association, were distributed widely over the United States. He was the author of many other papers and discussions, twenty-two titles appearing after his name in the Association's cumulative index. He was an honorary member of the New England Water Works Association, and member of the American Water Works Association, and the Maine Association of Engineers, the American Peony Society and the Lawn Bowling Club of St. Petersburg, Florida.

An ardent Mason since 1899 "Dave" Moulton served as Grand Commander of the Grand Commandery of Maine in 1933. He received the degrees of the Scottish Rite in 1912, and was Commander-in-Chief of Maine Consistory from 1928 to 1930. He received the Thirty-third Degree (Honorary) in 1925.

His life hobbies were farming and horticulture. On his farm at Falmouth could be found some of the best bred Jersey stock in America, while his acres were devoted to raising the rarest varieties of peonies, affording him not only a pleasant but a profitable pastime.

For a number of years he was president of the Portland Farm Club. Mr. Moulton is survived by his widow, two daughters and seven grandchildren.

## Smoke Stack To Be Sewer Vent*

The Green Bay Water Department originally had a steam pumping station and a few years ago they remodeled the station and modernized their pumping equipment by installing electric motor driven pumps. By so doing they abandoned their steam boilers and consequently had no further use for a large brick smoke stack, approximately 100 ft. high.

Being aware of the fact that they didn't need this stack the Metropolitan Sewerage District made an offer to the Water Department whereby the Green Bay Metropolitan Sewerage District offered to construct, for the Water Department, a steel stack of sufficient size and height to accommodate a new stoker fed plant heating boiler in turn for the use of this old brick stack.

The Water Department, feeling that a new stack would serve their purpose better than old one, accepted the Sewerage District's proposal and gave the District an easement across their property permitting the District to connect to the stack. Last fall the District advertised for bids for the 36 in. vent connection but the bids exceeded the estimate and therefore they were rejected. It is however expected that before long this job will be readvertised and we then will have a gravity vent line for the District interceptor.

By utilizing this gravity vent which will be connected through a 36 in. concrete sewer line to a 48-66 in. deep tunnel sewer, it is hoped that reasonable ventilation will be provided and the odors which are now emitted at a number of drop manholes will be eliminated.

*From the Wisconsin Clarifier, of the Wisconsin Conference of Sewage Works Operators. A contribution of Geo. Martin, Supt. Green Bay Sewerage District.

## Cleanliness and Godliness

In the early days in Finland, there was much done in preparation for Christmas.

The house had to be washed from top to botom; the floors covered with clean straw, on which the children slept, reminiscent of the Christ Child.

And just before the Christmas Eve celebration, the entire family had to take a Finish bath. And was *it* a bath!

# The Nature of Organic Pollutants in Relation to Stream B.O.D.*

*A Study of the Effects of Composition and Decomposition of Such Pollutants on the Oxygen Balance of Streams.*

*by* W. B. BOLLEN, *Prof. of Bacteriology, Oregon State College, Corvallis, Oregon.*

THE biochemical oxygen demand resulting from introduction of an organic waste into a stream is a function of (1) oxygen solubility, (2) microbial physiology, and (3) chemical composition of the waste. Stream characteristics also are concerned, particularly as influencing reaeration and benthal deposits.

### Solubility of Oxygen

Solubility of atmospheric oxygen in water is extremely low. Water saturated with air under normal pressure at 16°C contains 10 ppm. $O_2$. Since $N_2$ is less soluble than $O_2$, dissolved air is richer in $O_2$ than is the atmosphere. Solubility of the pure gases at one atmosphere pressure are considerably higher. To emphasize these properties and their physiological implications, values at some temperatures within the range of biological growth are given in Table 1.

## Physiology and Biochemistry of Microbial Decompositions

Microbial decompositions of organic matter are ultimately more or less complete oxidations carried on by the organisms primarily to secure growth energy. The extent of the decomposition is determined by species of microbe, nature of the organic matter, and availability of oxygen. Oxidations by aerobic organisms, using $O_2$, are essentially complete, and give mainly $CO_2$ and $H_2O$ as end-products and yield a maximum amount of energy. If the organic matter contains protein, the nitrogen and sulfur are likely to be liberated as ammonia and hydrogen sulfide, which are then subject to oxidation by the specialized nitrifying and sulfur-oxidizing bacteria.

Anaerobic oxidations or true fermentations are incomplete, yield much less energy and, in addition to $CO_2$, always give incompletely oxidized products, among which $H_2$, $CH_4$, alcohols, ketones and organic acids are typical. These are susceptible to eventual complete oxidation, by the same or other organisms, in the presence of atmospheric oxygen. Intermediate types of oxidation are carried on by various, and in some instances highly specialized, species of bacteria, using nitrate, nitrite, sulfate, carbonate, phosphate and perhaps other oxygen-containing radicals, including water, as oxidizing agents. The completeness and energy yield of these reactions, which will not occur in the presence of free oxygen, is intermediate between the aerobic and the fermentative oxidations. Some of their end-products also are subject to eventual complete oxidation by $O_2$.

Only aerobic oxidations are complete, and they are essential for stabilization of B.O.D. It cannot be overemphasized that the limited solubility of $O_2$ limits the rate of aerobic oxidation whenever the concentration of organic matter in general exceeds the concentration of dissolved oxygen. With a normal water flora consisting of aerobic, facultative and anaerobic bacteria, oxidations are likely to become completely anaerobic when concentrations of organic matter introduced into oxygen-saturated water exceed approximately 10 ppm. For material of vegetable origin, the carbon equivalent would average 4 ppm., and 10 ppm. of dissolved oxygen would be required for nearly complete oxidation.

Anaerobic conditions could exist and extend downstream, until concentration of the incomplete oxidation products, relatively carbon-and hydrogen-rich and readily decomposable fell to a lower limiting value. The reason for this is inherent in (1) the reaction $C+O_2 = CO_2$, which indicates one part of carbon requires 2-2/3 parts by weight of oxygen for complete oxidation, and (2) composition of the organic compounds. Since these compounds contain oxygen and hydrogen in varying amounts, the actual quantity of additional oxygen required for ultimate decomposition may be greater or less than the theoretical amount based on carbon alone.

In the case of sugars and other carbohydrates, where hydrogen and oxygen occur in the same proportions as in water, the oxygen demand for complete oxidation is directly proportional to the amount of total carbon. The same is true of furfural and some organic acids; in other organic acids the hydrogen-oxygen ratio may depart from 2:1 either way, and more or less $O_2$ may be required for complete stabilization. For many industrial wastes of biological nature, the carbon content should be reliably indicative of the ultimate oxygen demand. Hydrocarbons, however, present exceptionally high oxygen demands.

Ultimate B.O.D. values calculated on the basis of total carbon may in some cases be lower than the 20-day B.O.D. Examples appear in Table 3. These differences may be attributed to (1) organic substances or decomposition products having a hydrogen: oxygen ratio wider than 2:1, or (2) presence of sulfides, ammonia or other inorganic substances or radicals susceptible to aerobic oxidation. Liberation of combustible gases not oxidized in the B.O.D. test can account for higher theoretical values.

A fact often slighted by bacteriologists and others concerned with microbial oxidations is that cultures of many common bacteria, which are facultative, in liquid media exposed to air grow anaerobically for the most part; only at the surface does aerobic growth occur after dissolved oxygen in the body of the liquid is consumed. Growth of the surface

Table 1

SOLUBILITY OF AIR AND PURE GASES IN WATER AT NORMAL PRESSURE

(Data from "Handbook of Chemistry and Physics." 30th ed. pp 1396-7, 1947 Chemical Rubber Publishing Co., Cleveland, O.)

| Gas | 0°C | 10°C | 20°C | 30°C | 40°C |
|---|---|---|---|---|---|
| | ppm. | ppm. | ppm. | ppm. | ppm. |
| $O_2$ | 69.5 | 53.7 | 43.4 | 35.9 | 30.8 |
| $N_2$ | 29.4 | 23.1 | 19.0 | 16.2 | 13.9 |
| $CO_2$ | 3346. | 2318. | 1688. | 1257. | 973. |
| Air | 41.8 | 32.8 | 27.1 | 22.6 | 18.5 |
| $O_2$ from dis. air | 14.6 | 11.3 | 9.2 | 7.6 | 6.5 |
| $O_2$ in dis. air—% | 34.9 | 34.5 | 34.0 | 33.6 | 33.2 |

*Technical Paper No. 616, Oregon Agricultural Experiment Station.

A contribution of the Dep't. of Bacteriology, published with approval of the Director of the Station.

layer precludes penetration of atmospheric oxygen into the liquid below. Only by culturing in shallow layers or by using vigorous aeration can anaerobic growth be avoided. Obligate aerobes will grow only at the surface of a liquid. Conversely, the oxygen consuming power of aerobic organisms is commonly employed to facilitate development of obligate anaerobes by associated growth under ordinary aerobic incubation. This associated growth is in effect a form of symbiosis, and is widespread in the soil and elsewhere in nature.

An adequate supply of dissolved oxygen is not the only requisite for rapid, extensive decomposition of organic wastes in water; in addition, the waste material must provide a suitable ration for the bacterial crop that must grow to disintegrate it. Fitness as a ration is determined by availability or chemical structure of the constituents as influencing susceptibility to attack, and by available nitrogen. Sugars and proteins are readily utilized by most microorganisms. Celluloses and fats are less readily available and are utilized by only more or less specialized bacteria and fungi. Lignins, waxes and other highly resistant substances are decomposed only very slowly and by specific groups of organisms. In any case the decomposition is dependent upon a supply of nitrogenous food, since the biological objective of the microorganisms involved is growth; i.e., multiplication of cells. Microbial cells, especially those of bacteria, contain much nitrogen; hence, for their elaboration ammonia, nitrate, amino acid or some other form of nitrogen must be available as required.

### Need for Nitrogen

A limited supply of available nitrogen compounds will limit organic decomposition accordingly, except for the generally inextensive activity of the few species of *Azotobacter* and *Clostridium* that can assimilate dissolved gaseous nitrogen. Although decomposition will slowly proceed in the presence of only traces of available nitrogen, the rate is limited by the rate at which autolysis or microbial death permits the limited nitrogen supply to be repartitioned or used over and over again by successive generations. On the other hand, if the organic matter contains more nitrogen than will be required to construct the cells bringing about its decomposition, the excess will appear as a waste product, generally as ammonia. This subsequently leads to development of nitrifying bacteria and a consequent increase in oxygen demand.

Table 2

| Location | Annual Flow* mean | Annual Flow* minimum | Dissolved Oxygen mean | Dissolved Oxygen minimum |
|---|---|---|---|---|
| | cfs. | cfs. | tons/da. | tons/da. |
| Springfield | 4,860 | 850 | 130 | 23 |
| McKenzie Mouth | 4,760 | 1,710 | 129 | 45 |
| Albany | 12,600 | 1,860 | 340 | 50 |

*Data on flow obtained from War Department, Office of the District Engineer, Portland, Oregon.

The optimum amount of available nitrogen varies with the species of organism and environmental conditions as affecting physiology and biochemical processes of decomposition. For oxidation of organic matter by aerobic bacteria primarily involved in stream B.O.D. a carbon/nitrogen ratio of about 40/1 is most favorable. The reason for this may be found in relations existing between microbial cell composition and assimilation and dissimilation of carbon source.

Bacterial cell substance, on the average, contains 50 per cent carbon and 10 per cent nitrogen, dry basis, giving a CN ratio of 5/1. These constituents are derived from the medium. The organic substrate, however, must provide carbon not only for assimilation or growth but also for energy by oxidation or dissimilation. Different groups and species of bacteria vary considerably in efficiency of carbon utilization. From 70 to 99 per cent of the carbon may be dissimilated, while 1 to 30 per cent is assimilated or built into new cells. In general, anaerobic growth is less efficient than aerobic growth. Ten per cent may be taken as an average proportion of carbon assimilated from a substrate. For this carbon assimilation one-fifth as much nitrogen is required for cell synthesis.

When organic matter is added to water, the rate and extent of its primary decomposition, whether aerobic or anaerobic, is determined by the available nitrogen present. This nitrogen may be a constituent of the organic material or it may occur as ammonia or nitrate added with the waste or arising from a previous decomposition. From 200 to 250 parts of organic matter furnish 100 parts of carbon. On the average, 90 parts of this carbon will be dissimilated and 10 parts assimilated, for which 2 parts of nitrogen will be required. Since water ordinarily contains only traces of nitrates or ammonia, the added waste should have a C/N ratio of 40/1 to 50/1, thus carrying about 1 per cent nitrogen to prevent retardation of decomposition by nitrogen starvation. A deficiency of nitrogen retards effective utilization of dissolved oxygen.

For optimum decomposition in soils fresh organic matter must have a narrower C/N ratio, approximately 20/1[9]. This is because molds, predominating organisms in the first stage of decomposition in a normally aerated soil, where more $O_2$ is available than in a body of water, are more efficient than bacteria and assimilate 40 to 50 per cent of the substrate carbon. Therefore, even though their cells contain only half as much nitrogen as those of bacteria, their nutritional requirements for this food element are twice as great. If the organic matter contains more nitrogen

Table 3

ANALYSIS OF REPRESENTATIVE INDUSTRIAL WASTES AND SEWAGE OF THE WILLAMETTE REGION

| | pH | Total Solids | Total Sugars | Total Carbon | Total Nit. | C/N | B.O.D. 5 day | B.O.D. 20 day | Ultimate* |
|---|---|---|---|---|---|---|---|---|---|
| | | ppm. | ppm. | ppm. | ppm. | | ppm. | ppm. | ppm. |
| Apricots, freezepack effluent | 7.4 | 198 | 75 | 150 | 5 | 30.0 | 200 | 300 | 400 |
| Beans, cannery effluent | 6.0 | 1,589 | 60 | 100 | 8 | 12.5 | 150 | 150 | 267 |
| Beans, solid offal | 4.7 | 56,240 | 170 | 17,700 | 1,780 | 9.9 | 7,600 | 11,800 | 47,260 |
| Beets, cannery effluent | 3.4 | 4,260 | 50 | 1,820 | 99 | 18.4 | 3,000 | 6,200 | 4,860 |
| Cherries, cannery effluent | 7.1 | 424 | 40 | 180 | 0 | ..... | 600 | 3,400 | 480 |
| Corn, cannery effluent | 3.6 | 3,790 | 160 | 1,530 | 119 | 12.9 | 2,700 | 5,800 | 4,080 |
| Peaches, solid offal | 4.8 | 28,670 | 1,360 | 13,220 | 332 | 39.8 | 9,500 | 16,000 | 35,300 |
| Pears, cannery effluent | 3.5 | 5,880 | 140 | 2,780 | 56 | 49.7 | 3,750 | 5,500 | 7,420 |
| Peas, cannery effluent | 4.2 | 3,430 | 80 | 1,000 | 83 | 12.0 | 1,300 | 3,400 | 2,670 |
| Tomatoes, cannery effluent | 5.2 | 943 | 0 | 310 | 22 | 14.1 | 750 | ..... | 830 |
| Flax, retting tank waste | 5.8 | 2,230 | 30 | 1,130 | 10 | 113.0 | 2,100 | 3,000 | 3,020 |
| Wool, scouring water | 6.8 | 1,010 | 30 | 140 | 9 | 15.6 | 600 | 1,700 | 374 |
| Waste Sulfite Liquor | 3.1 | 85,950 | 17,500 | 38,730 | 50 | 774.6 | 8,800 | 14,000 | 103,400 |
| Sawdust, Douglas-fir | 4.0 | ..... | 1,550 | 498,000 | 800 | 622.5 | 30,000 | 40,000 | 1,328,000 |
| Scholler Stillage | 4.5 | 14,080 | 3,200 | 5,680 | 40 | 142.0 | 5,600 | 7,200 | 15,170 |
| Domestic Sewage | 7.3 | 997 | ..... | 400 | 14 | 28.6 | 140 | 230 | 1,070 |
| Digested Sewage Sludge | 7.0 | ..... | ..... | 220,000 | 22,200 | 9.9 | ..... | ..... | 587,000 |

*Theoretical; Calculated from $C + O_2 = CO_2$

than required for rapid assimilation, whether in soil or in water, the excess will be given off as ammonia, a by-product.

According to the pollutional load and dissolved oxygen concentration, the aerobic oxidation will be more or less rapid. In any case, perhaps far downstream, the oxidation eventually will be completed under aerobic conditions. Since aerobic bacteria are in general more efficient in utilization of substrate, their nitrogen requirements will be accordingly higher. To favor rapid decomposition of organic wastes by a mixed bacterial flora, a C/N ratio or 40/1 may be accepted as an upper limit to assure exclusion of possible nitrogen starvation. It should be recognized, however, that bacteria of low assimilative efficiency may find a C/N ratio as wide as 100/1 sufficient; moreover, a lower nitrogen supply may be adequate for a decomposition limited in rate by resistant structure of substrate, diminished oxygen supply, or other limiting factors.

Oxygen requirements for stabilization of wastes by artificial disposal employing tanks or filters may be considerably less than the requirements for complete natural oxidation. This is particularly true for biological wastes of mixed composition. Resistant constitutents either accumulate as sludge or so rapidly pass through that in effect they are removed from the system; hence, the oxygen demand is accordingly lowered. Relatively high concentrations of organic matter undergoing forced rapid oxidation require a greater proportion of nitrogen. According to Heukelekian[1] one part of nitrogen will be required for every 20 parts of B.O.D., which is equivalent to a C/N ratio of 7.5 on the basis of organic matter completely oxidized. This follows from imposed conditions not normally encountered in streams.

Thus composition, in addition to determining total oxygen required for stabilization, also influences the rate of stabilization. Other factors influencing the rate, course and extent of decomposition or organic matter by microorganisms are aeration, temperature and pH. When decomposition of plant tissue takes place in soil or in water containing dissolved oxygen the natural end product, susceptible to relatively slow further decomposition, is humus. Under the anaerobic conditions which exist in bogs organic residues are only partially decomposed and they accumulate to eventually become peat. It is of interest to note that coal and petroleum may represent end-products of microbial decompositions arrested by geochemical processes.

## Microorganisms Concerned in Decomposition

A universal microbial population insures the presence of microorganisms in adequate numbers and variety to provide through natural contamination a generally suitable inoculum for any organic waste introduced into water or soil. Microbes carried by air and water generally originate in the soil or from materials on its surface. Certain species characteristically survive and persist in water even relatively pure. Inevitable organic contaminations, however small, permit at least some multiplication. As a result, every water supply not essentially virgin has the organisms necessary to oxidize organic wastes, including even such substances as phenol, rubber, fats and mineral oils. Mineral wastes are subject to attack by the autotrophic flora. Wastes themselves tend to carry large inocula. Only under unusual conditions of pH or concentration is microbial activity inhibited, and dilution sooner or later overcomes these influences.

Approximately 90 per cent of the bacteria found in both clean and polluted water are gram negative rods. Most common genera are *Achromobacter, Pseudomonas,* and *Flavobacterium.* Other genera frequently represented include *Chromobacterium, Alcaligenes, Aerobacter, Escherichia* and *Corynebacterium.* These constitute the autochthonous or native microflora, though pure water will not support bacteria. According to the kind of pollution, other groups of bacteria develop and predominate; e.g., *Bacillus, Clostridium, Streptococcus, Sarcina, Streptomyces, Leptothrix, Thiothrix,* and others.

Little is known about the activities of molds in water. Most species are strongly aerobic and would develop extensively only on floating or littoral material. Submerged aerobic growth is possible with vigorous aeration, as employed in the industrial production of penicillin. Yeasts are rarely found in water.

Protozoa are abundant and active in many wastes. Frequently they develop in cycles alternating with bacteria. Their physiological activities have not been extensively studied in relation to organic matter transformations.

Algae often occur in considerable numbers, especially in shallow water where they can obtain sufficient light and essential minerals. They do not destroy organic matter; being autotrophic they synthesize it from carbon dioxide and water, thus having a completely mineral nutrition. They are of significance in water ecology because they add $O_2$, a waste product of their photosynthesis, to water, and because the tissue they synthesize becomes eventually available to other organisms.

Certain worms and insect larvae, although not microorganisms, should be noted because of their frequent occurrence in accumulations of organic debris. Their direct and indirect influence on decomposition processes cannot be completely evaluated from present knowledge.

Stream biology and ecological relationships of organisms in normal and polluted waters have been discussed by Bartsch[2] and Patrick[3].

These various organisms all play a part, often at a particular and critical point, in the cycles of elements in nature. The carbon and nitrogen cycles are prominent and most studied because these two elements comprise a large proportion of cell substance and are the ones most likely to be limited in availability and subject to competitive biological utilization. Although bacteria have received most attention in studies on organic decomposition and B.O.D., the other microorganisms undoubtedly contribute important effects, the significance of which awaits future investigation.

## Fate of Organic Matter in Water

Readily available material is utilized first. Sugars, proteins, and other simple biologic compounds are completely decomposed in a few days under aerobic conditions and other favorable environmental factors. The strength of these substances with respect to B.O.D. is high; they are high in energy, are readily attacked by many bacteria, and are rapidly stabilized in the presence of dissolved oxygen. A waste containing them can produce a sharp oxygen sag. Domestic sewage, which has a "normal" B.O.D., is 99 per cent stabilized in 20 days.

In general the aerobic decomposition of pure substances and of domestic sewage follows the monomolecular reaction law; i.e., the rate of reaction is proportional to the concentration of undecomposed material. Symbolically expressed in differential form, where

$C$ = initial amount oxidizable,
$C_t$ = amount oxidized after the time t,
and $C_t/C$ = fraction oxidized,
$\log C_t/C = -kt$, whence $C_t/C = 10^{-kt}$

For domestic sewage and some other wastes if t is expressed in days k is found experimentally to have a

value of 0.1 at 20°C; this indicates 20.6 per cent substrate is oxidized each day, 20.6 per cent of the remainder is oxidized the next day, etc., or the half-life is 3 days[9]. On the basis of original concentration of substrate, oxidation proceeds as follows:

| | |
|---|---|
| 20.6% is oxidized in | 1 day |
| 50. % is oxidized in | 3 days |
| 68. % is oxidized in | 5 days |
| 90. % is oxidized in | 10 days |
| 99. % is oxidized in | 20 days |
| 100. % is oxidized in | 100 days |

For lignin and other resistant substances t may be expressed in units of 10 days or more.

Cellulose often exhibits a slow B.O.D. Under some conditions it is rapidly oxidized but in certain trade wastes, especially those of mixed composition, the B.O.D. may be greatly prolonged. Extent of dispersion of the cellulose, nature of other substances associated with it, pH and the microorganisms involved are controlling factors in the decomposition[8,9,10].

Lignins are highly resistant and may not be extensively oxidized within a period of months or years; under anaerobic conditions they remain essentially undecomposed. As with cellulose, the nature of the lignin and of substances associated with it[9], and environmental factors control the rate and extent of oxidation.

B.O.D.s resulting from anaerobic changes in river muds or pollutional sediments occur at much slower rates, the first day oxidation often being less than one per cent of the total. Moreover, the rate is variable with time, decreasing as the deposit ages, so that the half-life, instead of being 3 days as for aerobic B.O.D., is approximately 3 months. To fit the reaction a retarded monomolecular curve is required[9]. Stream characteristics as well as depth, area and composition of benthal deposits influence their oxygen demands. These may range from the requirements for aerobic decomposition of flowing material to the negative demands of obligate anaerobiosis.

That polluted river muds may show long continued B.O.D. has been shown by McGowan, et al[9]. This could reasonably be assigned largely to resistant residual organic matter. Mud samples containing from 12 to 17 per cent volatile matter and 0.5 to 0.7 per cent Kjeldahl nitrogen showed 20-day B.O.D. values of from 500 to 3,000 ppm. At 100 days the B.O.D.s were from 6,000 to 23,000 ppm.; at 500 days, from 15,000 to 51,000; and at 750 days, at which time observations were discontinued and the reactions presumably incomplete, the B.O.D values ranged from 18,000 to 58,000 ppm. for the several samples. Analysis of the data[10] reveals that 15 to 25 years would be required for 99 per cent stabilization. It is thus evident that dissolved oxygen may be absorbed for years by polluting material deposited in still waters. When such deposits are disturbed, as by increased flow, channel changes or other agencies, the flowing B.O.D. load would increase and the benthal deposits downstream would build up, except for material transported to sea.

## Industrial Waste

Industrial wastes, because of mixed and varied compositions, may show B.O.D. curves quite different from the curve for domestic sewage and their oxidation may proceed at various and varying rates. Three well defined stages of decomposition, not necessarily separated in time of occurrence, and analagous to those outlined by Waksman[10] for organic decomposition in soil, may be recognized.

1. Stage of Rapid Decomposition.

In this stage the readily available material is utilized by a variety of microorganisms.

a. Minerals are liberated from organic matter. Nitrogen, if present in excess of microbial requirements (C/N ratio narrower than 40/1 to 20/1) will be liberated as ammonia.

b. Metabolites are largely $CO_2$ and $H_2O$ under aerobic conditions. With limited $O_2$ supply, acids, alcohols, $H_2$, etc., are formed. Should any $H_2$ or other volatile products not completely oxidized escape to the atmosphere, an equivalent of dissolved oxygen in the water is conserved. This occurs to a probably minor extent. Unless produced in rather high concentrations, such substances will be aerobically oxidized near or at the water-air interface by specific bacteria or groups adapted to utilization of the particular product of anaerobiosis.

c. Energy is released. Cells are synthesized; these die sooner or later, enter the decomposition complex, and eventually contribute resistant protein residues to the cumulative resistant end-product.

2. Stage of Reassimilation.

a. *Heterotrophic phase:* Involves a wide variety of microorganisms, which utilize as food the organic waste products of incomplete oxidation in the first stage. Some gaseous nitrogen may be fixed by *Azotobacter* and *Clostridium*. More microbial substance is synthesized. This may occur in successive repetition.

b. *Autotrophic phase:* Few and specialized species of bacteria, having an entirely mineral nutrition and requiring only $CO_2$ as carbon source, are involved and free oxygen is generally required. Ammonia is oxidized for energy by nitrifying bacteria. Other autotrophes utilize $H_2S$, $H_2$, CO, and $CH_4$, in similar manner.

3. Stage of Humification.

This is characterized by a gradual and continual decomposition of a humus-complex formed by accumulation of resistant residues and microbial proteins from preceeding stages of the over-all decomposition. From the B.O.D. standpoint, it represents practically complete stabilization. Effect of the biologically resistant materials on dissolved oxygen concentration may be negligible; whether or not they have other pollutional effects, particularly downstream, may depend on stream characteristics.

The water humus-complex is not unlike that which accumulates in soils and it performs a similar function in natural economy. Protein residues from dead bacterial cells and resistant lignins from vegetable waste tend to unite, forming a ligno-proteinate of high adsorptive properties for iron, aluminum, phosphate, silicate and other ions. The complex exhibits base-replacement properties. Although highly resistant, it is subject to slow but persistant decomposition by specific groups of simple and higher bacteria, which require free oxygen for their action. These bacteria constitute an autochthonous microflora, always present, always slowly active, on the humus accumulations at the bottom of streams and other bodies of water. Their ecological function is to liberate nitrogen and other food-elements from the complex in available form for re-use in the biological cycle.

At completion of the decomposition the average carbon balance, on the basis of 100 parts carbon in the original waste, will show 90 parts converted to $CO_2$, 5 parts in resistant lignin, and 5 parts in dead bacterial cells. The two last named forms combine to give the residual humus, which has a C/N ratio close to 10/1.

Water humus has received little consideration in its relation to B.O.D. because it represents effective disposal from the standpoint of local pollution. At shallow depths it supports aquatic plants; deeper deposits consume oxygen but slowly. Downstream implications, however, may be serious. Relatively deep deposits may foul the stream bed. Heavy pollutional loads may add cellulose or other substances to the humus; anaerobic fermentation of these admixtures, especially in warm seasons, may give rise to foul odors, produce a tremendous B.O.D.,

and effectively sterilize the locale with respect to higher forms of plant and animal life. Entrainment of gas in such bottom deposits may impart sufficient bouyancy to bring portions of them to the surface, where they produce offensive scums and shore deposits. Such conditions may be of no concern to upstream areas of pollution, but responsibility lies with the source.

While it is true that the potential oxygen demand of decomposing organic matter deposited on the water floor seldom is exerted in full, the liability is ever present. Whether the sediment remains undisturbed or continues to grow, anaerobic decomposition releases oxygen-consuming products to the water above. Although these products represent only a part of the oxygen consuming power of the accumulated deposit, gas-lifting or other resuspension may greatly increase the pollutional load. In this connection a survey and analysis of floor deposits of the Columbia and Willamette rivers would be of interest.

In its entirety the B.O.D. problem in stream pollution should be considered from the standpoint of complete oxidation of waste and the maximum free oxygen requirement. In many cases this can be referred to total carbon analyses, which would provide a readily determinable working basis and a reasonable margin of safety. Sooner or later this viewpoint, involving the ultimate fate of polluting material, must receive serious attention. The reports of McGowan, et al[7] and Fair, et al[4] give emphasis to the marked and continuously deteriorating effect of benthal deposits on the water of streams.*

Without reference to total carbon the ultimate B.O.D. may be recognized as the sum of (1) the aerobic or immediate demand, and (2) the anaerobic or potential demand. The latter is characteristic of the organic or benthal deposits on the water floor and contributes eventually, although more or less slowly, to the aerobic demand. It is a complex of conditions and reactions that lead to consumption of dissolved oxygen whenever encountered by contact with the surface of the deposit, by resuspension of the material, or by products of anaerobiosis rising to supernatant waters. Barring some effective benthal burial or sludge bank isolation, only the escape of combustible gases to the atmosphere would be likely to significantly lower the ultimate oxygen demand of a bio-organic trade waste as calculated from the carbon content. Higher than such theoretical demands could result from the presence of nitrogen and sulfur compounds, which give rise to oxygen-demanding ammonia and sulfide.

*For an extended discussion of benthal decomposition see Phelps[11], p. 119-131

## Industrial Wastes in Willamette Region

Industrial wastes are the largest and strongest sources of pollution of the Willamette River. They include paper mill and cannery wastes as major items. The lumber industry, through ponding and rafting of logs, contributes an undetermined but probably considerable portion of the pollutional load. The effects often extend far downstream. This is due not only to loads in excess of the oxygen capacity of portions of the stream concerned, but also to the wide C/N ratio of many of the wastes (Table 3). Cannery wastes from vegetable processing often contain sufficient nitrogen for rapid decomposition. Fruit processing wastes generally are deficient in nitrogen, and their stabilization will be delayed even in completely aerated water. Waste sulfite liquor, which contributes a major load in the lower reaches, has an extremely wide C/N ratio, contains a high percentage of resistant lignin, and can extend pollution for many miles.

A typical pea cannery waste averages 1,000 ppm. C in the seasonal daily effluent of 1,000,000 pounds. The 1,000 pounds C equivalent requires 2,700 pounds or 1.35 tons $O_2$ for complete oxidation.

An average paper mill discharges about 2,000,000 pounds of waste sulfite liquor per day. This contains nearly 80,000 pounds C, which will consume 100 tons $O_2$ for complete oxidation.

Oxygen supply of the Willamette river, assuming air saturation at 16°C. (61°F.), giving 54 lbs./da./cu.ft./sec. is as shown in Table 2 for the locations indicated. These places are on the upper industrial reaches of the stream, 80 to 135 miles from where it empties into the Columbia below Portland after a flow period of 7 to 10 days. It is apparent that at these places, in areas now undergoing extensive industrial development, the river could stabilize the cannery waste but it would be severely taxed by the paper mill and in seasons of low water it would be reduced to a dead stream. The implications of downriver pollutional effects are obvious.

To maintain a desirable biological balance, preserve fish life, and provide recreation facilities, the pollutional load of the river should be so minimized and admixed as to permit maintenance of at least 5 ppm. dissolved oxygen. Under the present development of industry and population in the Willamette Valley, this requirement cannot be met in many places without installation of suitable treatment plants for sewage as well as for industrial wastes. Such treatment will become mandatory in the near future. For appropriate design of disposal facilities, it is essential that qualitative as well as quantitative characteristics of wastes peculiar to each industry be determined. Some progress has been made in this direction.[2,3,9] Representative analyses are presented in Table 3.

Chemical composition, ultimate as well as proximate, must be recognized as a factor in waste stabilization. In studies on stream pollution and alleviation it must be given appropriate consideration along with reaeration, stream characteristics, and other factors affecting dissolved oxygen. All are facets of the B.O.D. problem.

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# Canton's Improved Garbage Collection System

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THE improved garbage collection system recently put into operation by the city of Canton, Ohio, appears to be the first major step forward since the introduction of the sanitary covered refuse truck.

When Canton first began the municipal garbage collection system some years ago, the city furnished a standard, covered can to each subscriber. At each collection, the used can was removed and carried to the disposal site, and a clean sterile can was left in its place. Cans were washed under contract at the farm where the garbage was disposed of.

In an effort to reduce the high cost of this system, without sacrificing the advanced principle of providing residents with clean cans as a sanitary measure, a prolonged study of garbage disposal systems was made.

Aside from the cost of having the cans washed under contract, another disadvantage of the original system was that the filled can had to be hauled on an open truck to the farm, undoing to some extent the good accomplished by furnishing clean cans.

After considering can washing plants and a number of other suggestions in connection with a much-needed garbage disposal plant, it was finally decided that the ideal solution to the problem would be to build a garbage disposal plant. Then on the collection routes, empty the can into a covered refuse truck, wash the can on the spot, and return the can to its place, taking the truck to the disposal plant only when full. The study revealed that the average can contained only 15 pounds of garbage, indicating that a covered-body type truck could handle 400 or more cans before taking the trip to the disposal plant. When carrying the cans along, the limit was 100 per trip.

When it came to reducing this scheme into a working reality, however, the late C. C. Hommon, Canton's progressive sanitary engineer, and E. W. Galloway of the Chicago consulting engineering firm of Alvord, Burdick & Howson, discovered that they were thinking a step ahead of the rest of the world. No one had developed a washing unit specifically for the use they envisioned.

### Mobile High Pressure Steam Cleaner Adapted

Having seen a Hypressure Jenny Steam Cleaner knocking grease from parts and machinery in a city garage, Mr. Hommon called on Homestead Valve Manufacturing Co., manufacturers of the unit, to see if their machines could be adapted to on the spot garbage can cleansing and sterilization. Homestead engineers had no trouble in altering one of their production line models to do everything that these experts wanted.

An experimental truck, complete with the high pressure washing equipment, was put into service, and results over more than a year were so completely satisfactory that orders were placed for eight more of these trucks. All but one are now in service, and have already retired the 12 flat bed trucks formerly used.

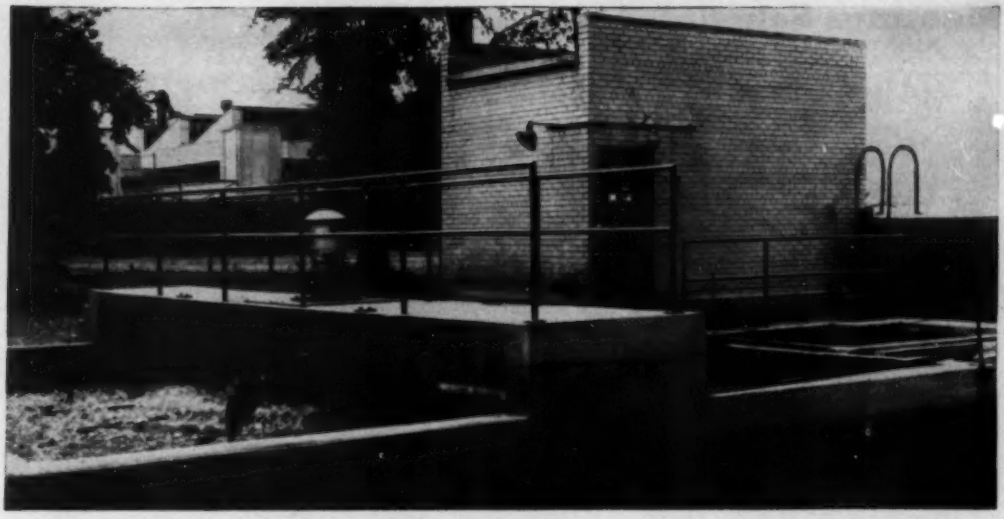
As the system now operates, the can of garbage is carried to the rear of the truck, where it is emptied into the self-dumping scoop. The empty can is then taken to the washing chamber on the side of the truck, where it is inverted over a multiple nozzle arrangement and the high pressure water-steam spray turned on for about ten seconds. The cleansed and completely sterile can is then ready to be returned. In freezing weather, cans are placed first in the thawing chamber just forward of the washing compartment, where they are warmed sufficiently for the frozen contents to slide out when the can is inverted.

The hot water is used only once, the spent water being caught in a tank under the cleaning chamber as the can is washed. When this tank becomes filled, it is a simple matter to pull up to a sanitary sewer manhole and empty it.

Garbage, of course, is carried to the disposal plant in the completely enclosed body. At any point where the area around a can has been allowed to become unsanitary, a steam line may be run from the truck and the area completely sterilized.

In addition to being a sanitary method of handling the garbage, it is estimated that the improved system will save the city upwards of $25,000 a year.

**One of Canton's Nine Garbage Trucks Equipped with a Hypressure Jenny Steam Cleansing Unit.** *One can is being cleansed and sterilized and another is in the thawing compartment forward.*



# CHICAGO "PAKAGE" PLANT

## For Small Communities • Industrial Plants • Institutions

"Pakage" Plants require a minimum of operating supervision, produce a sparkling clear effluent, are free from flies, foul odors, and unsightly appearance. Can be located near dwelling.

Initial cost is low. Operating costs are nominal.

Local Operators without previous sewage treatment experience successfully operate these plants. Former farmers, salesmen, coal-miners, truck-drivers are operating existing plants and performing other municipal duties.

Aeration and clarification are performed in a single tank with positive, automatic sludge control. One sludge setting covers a wide range of sewage flows and strengths.

Since 1934 over 200 plants have been installed and are successfully operating.

The "Pakage" plant was specifically developed for small populations and can be engineered to meet requirements. Complete literature available.

## CHICAGO PUMP COMPANY

### SEWAGE EQUIPMENT DIVISION

**2300 WOLFRAM STREET** — **CHICAGO 18, ILLINOIS**

Flush Kleen, Scru-Peller, Plunger, Horizontal and Vertical Non-Clogs Water Seal Pumping Units, Samplers,

Swing Diffusers, Stationary Diffusers, Mechanical Aerators, Combination Aerator-Clarifiers, Comminutors.

# Meetings Scheduled:

June 4-5—Grand Rapids, Mich. *(Hotel Pantlind)*
MICHIGAN SEWAGE & INDUSTRIAL WASTES ASS'N. Sec'y, Donald M. Pierce, State Dept. of Health, Room 334, Administration Bldg., Lansing 4, Mich.

June 7-8—Springfield, Mass. *(Hotel Kimball)*
NEW ENGLAND SEWAGE & INDUSTRIAL WASTE ASS'N. Sec'y, Walter E. Merrill, State Dept. of Health, 511A State House, Boston, Mass.
(Joint Meeting)
NEW YORK SEWAGE & INDUSTRIAL WASTES ASS'N. Sec'y, Ralph C. Sweeney, 21 N. Broadway, White Plains, N. Y.

June 11-14—Tuscaloosa, Ala. *(University of Alabama)*
ALABAMA WATER & SEWAGE WORKS SHORT SCHOOL, Director, Prof. G. H. Dunstan.

June 15—
ALABAMA WATER & SEWAGE WORKS ASSOCIATION. Sec'y, Alex O. Taylor, Box 69, Auburn, Ala.

June 13—York Harbor, Me. *(Joint Conferences)*
MAINE WATER UTILITIES ASSOCIATION. Sec'y, Earl A. Tarr, Winthrop, Me.
NEW ENGLAND WATER WORKS ASSOCIATION. Sec'y, Jos. C. Knox, 73 Tremont St., Boston, Mass.
NEW HAMPSHIRE WATER WORKS ASSOCIATION. Sec'y, W. A. Healy, 17 Capitol St., Concord, N.H.

June 18-22—State College, Pa. *(Pennsylvania State College)*
FOURTH ANNUAL WATER WORKS SCHOOL. Director, R. Rupert Kountz, Dept. Civil Engineering, Pennsylvania State College, State College, Pa.

June 20-22—Columbus, Ohio *(Neil House)*
OHIO SEWAGE AND INDUSTRIAL WASTES TREATMENT CONFERENCE. Sec'y, J. E. Richards, 302 Departments Bldg., Columbus 15, Ohio.

June 25-29—State College, Pa. *(State College, Pa.)*
FOURTH ANNUAL SEWAGE WORKS SCHOOL. Director, R. Rupert Kountz. Dept. Civil Engineering, Pennsylvania State College, State College, Pa.

June 29—Trenton, N.J. *(De Laval Steam Turbine Plant)*
NEW JERSEY SECTION A.W.W.A. (Summer Meeting.) (Inspection Trip and Luncheon.) Sec'y, C. B. Tygert, Box 178, Newark, N.J.

Aug. 20-22—Toronto, Ont. *(Royal York Hotel)*
CANADIAN INSTITUTE ON SEWAGE & SANITATION. Sec'y, A. E. Berry, Parliament Buildings, Toronto, Ont.

Aug. 20-22—State College *(Nittany Lion Inn)*
PENNSYLVANIA WATER WORKS OPERATORS' ASSOCIATION. Sec'y, R. Rupert Kountz, Penna. State College, State College, Pa.

Aug. 22-24—
PENNSYLVANIA SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Sec'y, B. S. Bush, Dept. of Health, Kirby Health Center, Wilkes-Barre. Pa.

Sept. 6-7—Plattsburg, New York
NEW YORK SECTION A.W.W.A. Sec'y, Rollo K. Blanchard, 50 West 50th Street, New York, N.Y.

Sept. 10-12—Boston, Mass. *(Hotel Statler)* NEW ENGLAND WATER WORKS ASSOCIATION (Annual convention). Sec'y, Jos. C. Knox, 73 Tremont Street, Boston 8, Mass.

Sept. 11-13—Marshalltown, Iowa *(Hotel Tall Corn)*
IOWA SEWAGE WORKS ASSOCIATION. Sec'y, Leo Holtcamp, P.O. Box 310, Webster City, Ia.

Sept. 12-14—Minneapolis, Minn. *(Hotel Nicollet)*
MINNESOTA SECTION A.W.W.A. Sec'y, Leonard N. Thompson, 216 Court House Bldg., St. Paul, Minn.

Sept. 16-19—Detroit, Mich. *(Veterans Memorial Bldg.)*
AMERICAN PUBLIC WORKS ASSOCIATION. (Annual Convention). Director, D. F. Herrick, 1313 East 60th St., Chicago, Ill.

Sept. 17-19—Louisville, Ky. *(Kentucky Hotel)*
KENTUCKY-TENNESSEE SECTION A.W.W.A. KENTUCKY-TENNESSEE INDUSTRIAL WASTES & SEWAGE WORK ASSN. Sec'y, R. P. Farrell, 420 Sixth Ave., N., Nashville 3, Tenn.

Sept. 19-21—St. Joseph, Mich. *(Whitcomb Hotel)*
MICHIGAN SECTION A.W.W.A. Sec'y, T. L. Vander Velde, 2609 E. Saginaw Street, Lansing 12, Mich.

(Continued on page 94A)


**These are Impressive Performers**

NON-CLOG SIZES UP TO 8"
HEAVY and LIGHT DUTY
Type KS Aurora Heavy Duty Non-Clog Sump Pump
Every detail of Aurora Vertical Sump Pumps has been selected or developed with the definite purpose of achieving lasting, trouble-free and efficient operation.
Write for Bulletin 104

DISTRIBUTORS IN PRINCIPAL CITIES
AURORA Always PUMPS
AURORA PUMP COMPANY
68 LOUCKS ST., AURORA, ILL.

Dependable because they are tough and rugged. Made to withstand the wear and tear of the modern day strain and stress. For generations of incomparable service, only cast iron pipe can qualify. Serving the industry with Super de Lavaud Cast Iron Pipe, centrifugally, in modern lengths.

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ALABAMA PIPE COMPANY
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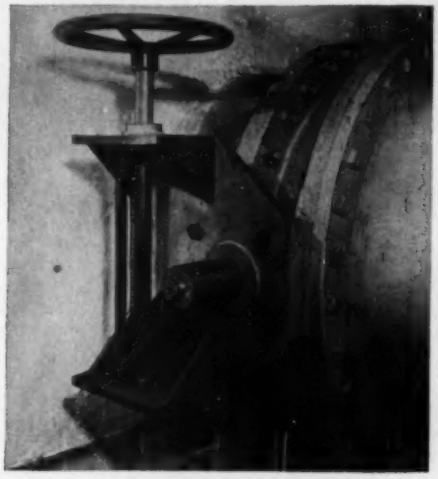
# R-S valvEvents

• EXCERPTS FROM THE R-S BOOK OF EXPERIENCE •



## RUGGED Simplicity

Correctly engineered mechanically and metallurgically, all body assemblies of R-S Valves equal or exceed A. S. A. standards in every detail. These valves are designed and constructed for rugged service and provided with such safety factors that they will exceed service expectations as well as reduce pumping and blower costs.

Consider also the few working parts, greater control rangeability, the self-cleaning feature and the fact that R-S Valves are readily adapted to automatic operation. Know the rugged simplicity of R-S Valves, and get the most from your valve investment.

District offices are listed in telephone directories as, "R-S Products Corp'n Valves".

**R-S PRODUCTS CORPORATION**
**4600 Germantown Avenue, Philadelphia 44, Pa.**
*An S. Morgan Smith Company Subsidiary*

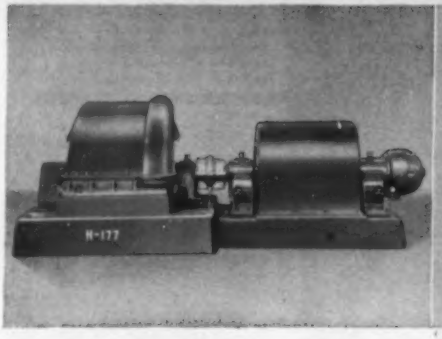
No. 782—Heavy Duty Rubber Seated Wafer Type Valve with 5° angle seated vane and enclosed gear reduction drive. Gland can be removed and stuffing box repacked without removing prime mover.

No. 739-740—Sixty-inch, 50-pound Heavy Duty Valve with gear reduction drive and handwheel for handling water at 40 psig. Vertical valve stem enclosed in steel pipe support. Thrust bearing absorbs vertical load.

No. 730—R-S Heavy Duty Floor Stand for rugged service in connection with any standard R-S handwheel operated valve.

No. 767—A 3-Way Valve (Two 24-inch 125-pound Cast Iron Valves bolted to 125-pound American Standard Tee). Electric motor operated by cross linkage. Automatic declutching handwheel for emergency operation.

# Take no chances on V-P-L



CENTRIFUGAL

One of three, Type H, 3-Stage Centrifugal Blowers in a metropolitan sewage treatment plant. Capacity 15,000 cfm. Other plants in this same city are also equipped with R-C units.

V for Volume—P for Pressure—L for Low power cost.

Those are three essentials for adequate blower performance. You're sure of all three, with Roots-Connersville Blowers and related equipment.

That's the case whether your plant calls for Centrifugal or for Rotary Positive units. You can have either type, from the exclusive R-C *dual-ability line*. Capacities range from 5 cfm to 100,000 cfm, thus permitting the selection of a size closely matched to your specific demands. Frequently, this freedom of choice saves time, cost, space, weight and power.

R-C engineers will gladly help you select the right blowers with the V-P-L needed to provide reliability and economy.

ROOTS-CONNERSVILLE BLOWER CORPORATION
510 Mount Avenue, Connersville, Indiana

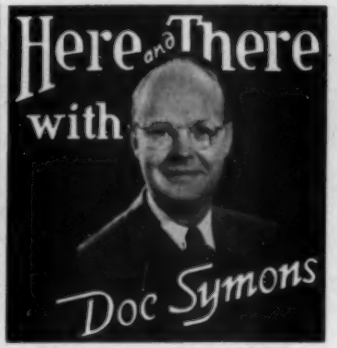
ROTARY

R-C Rotary Positive Blower in sewage treatment service in a small midwestern city. Capacity 600 cfm.

ROOTS-CONNERSVILLE

BLOWER BUILDERS SINCE 1854

ONE OF THE DRESSER INDUSTRIES


**H.T.M.A.**—And this being the June issue, I really should start telling you the story of the AWWA Convention in Miami.—But—I'm a lazy cuss and would rather do it the easy way. So, instead of rushing to my typewriter the minute the meeting is over in order to beat a deadline, I'm going to do this "letter" before the meeting starts.—Besides, I have to do the first installment of the report on that meeting as soon as it's over (you'll find it up front, this issue, somewhere). So next month we'll take up the Miami Convention. Right now, let's clear those few odds and ends I mentioned last month.

* * *

Jack J. Hinman, Jr. (the Big Man from Iowa City, Iowa) was Visiting Professor of Sanitary Engineering at the Univ. of North Carolina last autumn, while H. G. Baity was in Europe for W H O. Jack sent us the following:

"On Tuesday, Oct. 10, 1950, an incident occurred at the Winston-Salem Fair Grounds—The Forsyth County Fair.—Some practical jokers inserted a 2 lb. 3 oz. catfish through the steamer connection of a fire hydrant soon to be flushed. When the hydrant was opened, out popped the fish. A lady passerby at the moment, saw the fish, called a reporter, and that night the newspaper carried the story, a picture of the fish and comment on its apparent origin. This resulted in a tremendous amount of fan mail for Stanford E. Harris, Supt., Water and Sewerage Division, Winston-Salem, N.C.

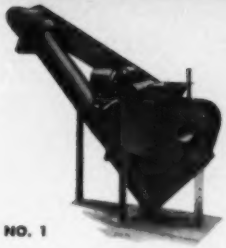
"It also resulted in a bit of by-play at the meeting of the No. Car. Sect. of AWWA. Mr. Davis of the firm of Piatt and Davis provided a live catfish and I presented a scroll duly signed by the officers of the Section and awarded along with the other awards at the meeting. The scroll read as follows:

To all to whom these presents shall come, Greeting—

(*Continued on page* 88A)

# GRIT WASHING WITH THE JEFFREY

(Reg. U. S. Pat. Off.)



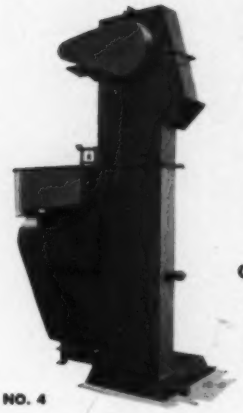
NO. 1

Scrubbing grit, freeing adhering organic solids and rejecting them with the overflow, classifying the products . . all these can be done efficiently with Jeffrey JIGRIT Washers (Patented), a type and size to meet your need exactly.

It has been shown by field studies that grit should be collected by one mechanism and washed in a separate unit. Jeffrey builds both . . collectors of the chain and scraper or chain and bucket type, or a combination of the two . . a series of Grit Washers as shown on this page.

Typical arrangements are available in drawing . . let us help you select the best means for collecting and removing grit from the channels.

NO. 9
FOR LARGE PLANTS



NO. 4

**Other Jeffrey Equipment for Sewage, Water and Industrial Waste Treatment:**

| | | |
|---|---|---|
| Bar and Disc Type Screens | Sludge Elevators | Garbage Grinders |
| Screenings Grinders | Chains and Sprockets | Scum Removers |
| Sludge Collectors | Chemical Feeders | Conveyors |
| Grit Collectors and Washers | FLOCTROLS | |

Send for Catalog No. 333

| | 1 | 4 | 9 |
|---|---|---|---|
| Capacity | 20 cu.ft. per hour | 120 cu. ft. | 280 cu.ft. |
| Removes | 80% Organics | 90% | 90% |
| Recovers | 90% Inorganic grit | 90% | 90% |
| Feed Water | 15 Gal. per min. | 45-70 g.p.m. | 100-140 g.p.m. |

# JEFFREY

ESTABLISHED 1877

Complete Line of Material Handling, Processing and Mining Equipment

***Here's the Key to...***

**√ Lower Treating Costs**

**√ Higher Plant Efficiency**

**√ important Savings in Chemicals**

***in both small and large plants***

# BECKMAN pH CONTROL

**THE BECKMAN MODEL H-2 pH METER** is one of a complete range of Beckman pH Meters available for every type of application*. The H-2 is particularly recommended for applications where high accuracy and simple operation—combined with the convenience and low cost of 115-v. AC operation—are desired.

It provides instant and direct pH readings, and a simple, built-in dial permits quick, convenient temperature compensation over the entire range of 0° to 100°C (32° to 212° F.). High reading accuracy is assured by wide-spread dual range scale that reads from 0 to 8 pH or from 6 to 14 pH at the turn of a switch. Same switch also provides instant millivolt readings from 0 to ±800 mv and from ±600 to ±1400 mv for titrations and oxidation-reduction measurements.

Built-in electrode support and compact case design save valuable space and permit easy portability to various plant locations.

*Particularly important is the wide range of factory-sealed, maintenance-free Beckman Glass Electrodes available for use with this instrument . . . electrodes that are virtually unbreakable . . . that cover extreme temperature ranges from below freezing to above boiling . . . that have an unprecedented pH range with negligible errors . . . that are abrasion-resistant and chemically durable to a degree never before thought possible in glass electrodes.*

---

*In addition to the H-2 Meter, other Beckman pH equipment includes completely automatic pH indication and control instruments for large-scale process applications . . . battery-operated models for complete portability in plant and field use . . . and a laboratory type instrument that features maximum versatility and accuracy for research and laboratory applications

Regardless of whether your plant is large or small . . . regardless of whether you are building a new plant, modernizing present equipment or making the most of what you now have, remember this—**no water or sewage plant is completely modern without Beckman pH Control!**

**IN SEWAGE TREATING OPERATIONS** and industrial waste disposal, accurate pH control is essential for optimum sludge digestion, for minimizing odor, for obtaining maximum settling and filtration, for assuring proper clarification and neutralization of effluent before discharge into rivers—all at lower chemical costs and greater plant efficiency.

**IN WATER TREATING OPERATIONS** accurate pH control is important in every one of the major treating steps. Each *Coagulation* process has its own narrow pH limit at which maximum floc and settling rate occur. In *Softening*—whether lime-soda, zeolite or organic ion exchange—optimum results can be obtained only with modern pH control. In *Neutralization*, accurate pH control is essential to regulate the process to changes in pH of the incoming water and to insure a neutral finished water that minimizes corrosion in mains, pipe lines and industrial operations.

**Do you have a copy of this informative booklet?**

It contains a great deal of helpful data on the application of pH control to modern water and sewage processes and discusses the various methods used. Your authorized Beckman dealer will be glad to supply you with a copy and to give any assistance you may wish in the application of pH control to your particular operations. Or write direct.

BECKMAN INSTRUMENTS
control modern industries

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**NATIONAL TECHNICAL LABORATORIES**
**South Pasadena 20, California**

# SUSPENDED SOLIDS SPECIALIST

**Look through an a.c.f. CYLINDRICAL Plug Valve, and you'll see why solids pass through easily. No restriction to retard flow. Besides, even tough, stringy solids won't keep an a.c.f. CYLINDRICAL Plug Valve from closing. The sharp edges of the plug shear lading obstructions, cleanly and easily. Small wonder a.c.f. Lubricated Plug Valves are number one preference in the sewage field!**

a.c.f. CYLINDRICAL FULL PIPE AREA **PLUG VALVES**

Representatives in 50 Principal Cities

Ask for Catalog 4-WS. American Car and Foundry Company, Valve Division, 1501 East Ferry Ave., Detroit 11, Michigan

(*Continued from page* 84A)

Know Ye that reposing special confidence in the zeal, industry, ability, veracity, and piscatorial acumen of

**Stanford E. Harris**

do hereby designate and appoint him to be

MAGISTER PISCATORIUM CUM LAUDE AND CURATOR OF THE AQUARIUM

And we duly charge all Nematognathi, all members of the genus Ostario-physi, all members of the species Siluridae, Ameuridae, Ariidae, Loricariidae, and all spotted dogfish, all horned pout, all channel catfish, all mud catfish, etc., in or near the city of Winston-Salem to be obedient to his orders and directions—

And to desist and remain away from and to stay out of all piping systems carrying potable water, all venturi tubes, all elevated tanks, and all house meters in the City of Winston-Salem—etc., etc., etc.

Done in the city of Durham, State of No. Carolina, in the name of the North Carolina Section of the Amer. Water Works Assn., this 14th day of November, 1950—

Signed **E. R. Tull, Chairman, E. C. Hubbard, Secretary.**

Somehow I have a sneaking suspicion that one Jack J. Hinman, Jr., not only presented the catfish and scroll but actually wrote the thing.

**WITHOUT REMOVING THIS PIPE FROM THE GROUND** holes resulting from exterior or interior corrosion have been permanently filled by the thin coating of cement mortar mechanically applied to the interior of the pipe by the Centriline process.

Internal corrosion has been *eliminated*. Centrilining also increases the pipe's flow capacity and cuts pumping costs.

The ingenious Centriline machine utilizes centrifugal force in applying the cement. Pipes in diameters of 4" to 144" can be lined by Centriline at *a fraction* of the cost of installing new pipes. Make pipes better than new through cement lining.

***OUR ENGINEERS ARE READY TO HELP YOU . . . WRITE TODAY***

**CENTRILINE CORPORATION**

*CEMENT MORTAR LININGS FOR NEARLY 3,000,000 FEET OF WATER, OIL AND GAS MAINS . . .*

*A subsidiary of Raymond Concrete Pile Co.*
**140 CEDAR STREET, NEW YORK 6, N. Y.**
*Branch Offices in Principal Cities of United States and Latin America*

***ON THE WEST COAST, WRITE AMERICAN PIPE & CONSTRUCTION COMPANY P. O. BOX 3428, TERMINAL ANNEX, LOS ANGELES, CALIFORNIA***


Many of you know that Uhl T. Mann, of Syracuse, N.Y., has made a name for himself in the operation of the Ley Creek Sewage Plant—But success in that family is not his alone—Mrs. Uhl T., better known as Louise Mann, is a commercial dress designer of note:—And I predict that one of these days her name will be in the big leagues along with Mainbocher, Ceil Chapman, Christian Dior, Wragge, Elizabeth Hawes, etc., etc.

* * *

Last October, at the Federation meeting in Washington, I did my darndest to interest Louise in my campaign for comfortable summer clothes for men.—When you male readers are sweltering this summer in your unscientifically designed suit, shirt, and tie, just say a little prayer asking Louise Mann to help us poor devils with some sensible clothes design.

* * *

WHAT'S IN A WORD DEPT.—Most of us have limited vocabularies at best, and overwork the words we know. On the other hand, the English language has too many words with more than one meaning, or at least with several connotations. Take the case of Prof. De Witt, of Michigan State College, who was speaking at the Purdue Industrial Waste Conference in February.

You should have seen W. H. (Pete) Wisely's hair stand on end when Prof. De Witt spoke about "Sensible Pollution." Pete vows there is no such thing as sensible pollution.—But, I must admit, that Prof. De Witt's use of the word was correct.—Maybe we should adopt George Bernard Shaw's 40 letter alphabet to help us out.

* * *

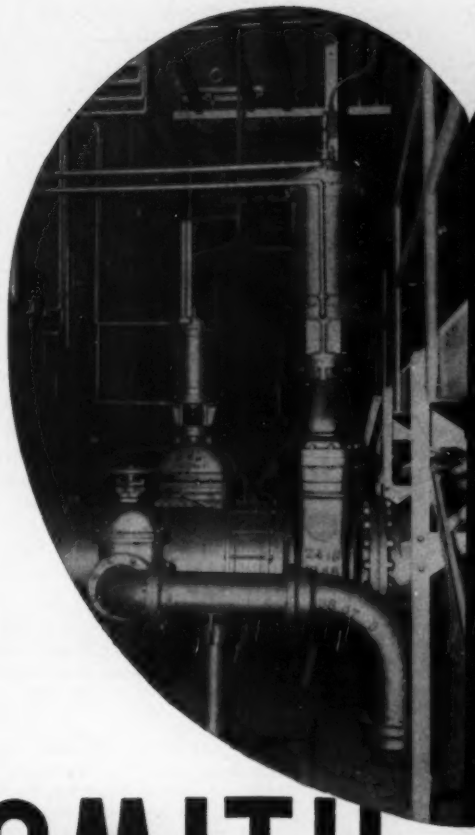
It was also at the Purdue Industrial Waste Conference that a young chap came up to me and introduced himself as one of my readers.—He was T. C. (Ted) Hoppe of Black and Veatch, Cons. Engr., Kansas City.

"Ted" told me that our old friend E. L. (Blueprint Now) Filby was back on the job wearing a corset to shore up his back, still weak from the auto accident near Indianapolis last October.

* * *

EXCUSE PLEASE!!—In the March issue, you may recall, I commented on how many of these columns I had written, and how I, a timid neophyte, approached this columning wondering if I'd ever reach five years of columns as did A. M. Rawn, Gen.

(*Continued on page* 90A)



THE HEART OF THE RICHMOND FILTER PLANT

# SMITH VALVES

Heart of the new Richmond Filter Plant are a number of Smith-designed, Smith-built, Richmond Specification 300 lb. test Pressure Gate Valves. Valves vary from 8″ to 30″ in size and are continually being opened or closed for accurate regulation of the flow of raw water, wash water and filtered water. Most of the Valves are hydraulically operated of the Square Bottom Case and Disc Type with wash water Valves provided with throttle track construction. Long life is assured by the Square Bottom construction which prevents the downstream disc tilting into the port opening and minimizes disc and seat ring wear. The Cast Iron Brass Lined Hydraulic Cylinders were fitted with limit switches with red and green lights indicating the fully closed or fully open Valve positions. This construction eliminated the need of complicated mechanical position indicators. Wash water piping expansion and contraction is compensated for by using Valves with a flanged and a plain end to accept a mechanical joint coupling. All Valves supplied by Smith for the Richmond Filter Plant were skillfully designed, engineered and ruggedly constructed for dependable long life service under frequent and severe operating conditions. Write for information on Smith Filter Plant Valve design.

THE A.P. SMITH MFG. CO. · SINCE 1896 ·

## THE A.P. SMITH MFG. CO.

EAST ORANGE, NEW JERSEY

(*Continued from page 88A*)

Mgr. of the Los Angeles County Sanitation District. In that piece, I said I thought his column had appeared in *Western Construction News* — I guessed wrong—as witness this letter from W. R. Updegraf, Editor and Manager of *Western City*, who wrote "Dear Doc Symons: I have read and enjoyed your column for years. However, the second item in the March contribution gave me a bit of a jolt where you credited A. M. Rawn's columning effort to *Western Construction News*. That column, Doc, appeared in *Western City* under the title of "Sewage Problems and Progress" for five years until A. M.'s war responsibilities necessitated its conclusion, but A. M. Rawn is still one of our favorite authors and people, as I know he is yours (You can say that again, brother). — Cordially yours, Winston R. Updegraff."

Of course, I apologize to both Mr. Updegraff AND *Western City*, but I'd never have known that I have such a distinguished editor among my readers if I hadn't made the mistake. Making a mistake in print is the surest way I know to get mail.

2
1
3
3-purpose part. Ingenious design is a feature of Mathews Hydrants—for example, use of a shield operating nut of high tensile iron. This serves three purposes.
1 It protects the soft bronze revolving nut from wrench wear.
2 It is cheaper to replace in case of damage by pipe wrenches or other improperly fitting tools.
3 It prevents dust, snow, rain or sleet from getting in around the revolving nut, always assuring free and quick operation.
MATHEWS
HYDRANTS
Made by R. D. Wood Company
Public Ledger Building
Independence Square, Phila. 5, Pa.
Manufacturers of "Sand-Spun" Pipe (centrifugally cast in sand molds) and R. D. Wood Gate Valves
Mathews Modernized Hydrants offer these advantages
All working parts contained in quickly replaceable barrel • Stuffing box cast integral with nozzle section —positively leakproof • Head turns 360° • Replaceable head • Nozzle sections easily changed • Nozzle levels raised or lowered without excavating • Protection case of "Sand-Spun" cast iron for extra strength, toughness, elasticity • A modern barrel makes an old Mathews good as new


## KIT'S KARICATURES

And next month, I've an interesting story on Earnest Boyce, current VeeP of the Federation.

* * *

Speaking of the Federation, two or three times lately, I've been discussing the points of joint interest of the AWWA and the Federation, and the fact that the Water & Sew. Wks. Mfrs. Assn. handles both organizations, etc. The thought occurred to me, and I mentioned it to several persons, that with these common interests, it would be a fine thing if the President and Secretary of the Federation were to attend each of the annual meetings of the AWWA and vice versa. Everyone I talked with agreed with me, and one of them said, "Why don't you mention the idea in your column and see what people think of it." Well, what do you think???

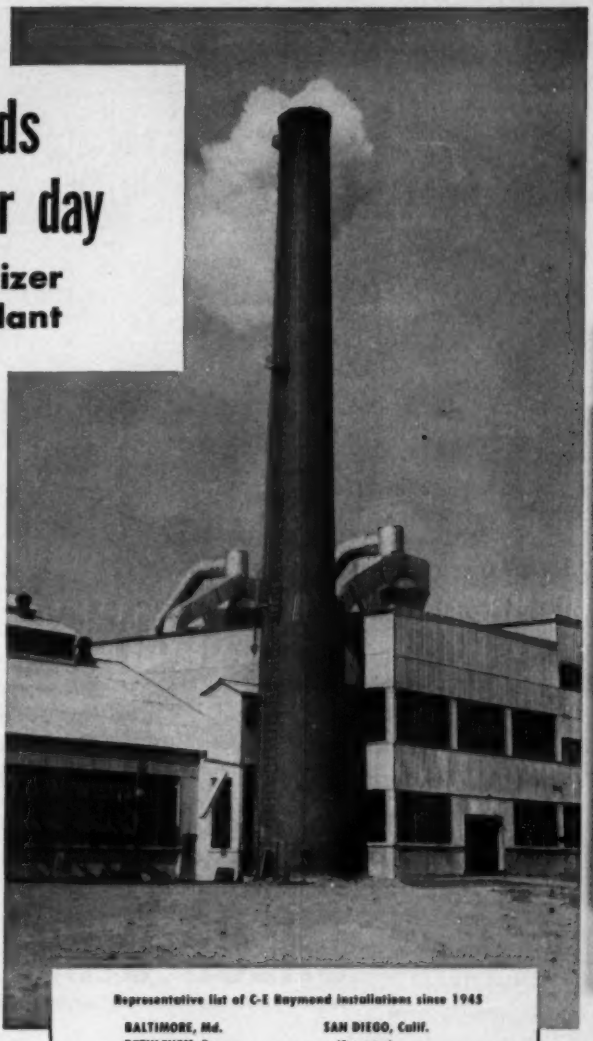
* * *

In a recent column I said I'd like to start a feature in which, each month, I'd "Take My Hat Off To" someone who had earned a little public recognition. I ask for suggestions as to (1) a name for the feature and (2) persons deserving of such mention. In accordance with my regular batting average, I received my usual "two letters," one from "Kit" (T.V.A.) Kittrell and one from "Art" (Waukesha Water) Kuranz. Both suggested persons (whom I shall use one of these days) and "Art" suggested that I call the feature "Man of the Month" and that I ask each AWWA Section Secy. and each Sewage Association Secy. to submit the name of one person they thought worthy of mention in the feature. *O.K.*—I'm open for suggestions. Meanwhile—

(*Continued on page 92A*)

# 750,000 pounds of filter cake per day

## converted to fertilizer at new Houston Plant



Another step in Houston's long range plans for complete waste treatment was finished last August with the opening of a C-E Raymond equipped, 28,000 tons per year municipal sewage sludge drying plant.

The two new Flash Drying Units, located at Houston's North Side plant, dry activated-sludge from both the North Side and Sims Bayou plants. Most of the dried sludge is marketed locally for fertilizer but some is shipped as far as the East Coast.

This new plant, designed to serve an equivalent population of 775,000, is equipped with two C-E Raymond Flash Drying Units, each having an evaporation rate of 12,000 pounds per hour.

The Houston Plant is typical of C-E Raymond System installations, now in service in virtually all parts of the country, meeting the varying requirements of both large and small communities. They are flexible in layout, highly efficient and thoroughly reliable; they provide for maximum utilization of waste heat.

The services of C-E specialists are available to assist you in finding the best solution to *your* sludge disposal problem. Get in touch with the office nearest to you for prompt attention.

**Industrial sludges a problem?**

*C-E Raymond Flash Drying and Incineration Systems have been the answer for others. Write for information.*

**Representative list of C-E Raymond installations since 1945**

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CHICAGO, Ill. (W. Southwest)
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HOUSTON, Texas
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SAN FRANCISCO, Calif.
SCHENECTADY, N. Y.
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**FLASH DRYER DIVISION**

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Western Office: 560 W. Sixth, Los Angeles 14, Calif. • Eastern Office: 200 Madison Ave., N. Y. 16, N. Y.

B-490

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT

(*Continued from page 90A*)

I'd like to "Tip My Hat To" Harrison Hale, Prof. of Chem. at Arkansas University, and W. R. Spencer, of Fayetteville, Ark., for their long time service of 20 years, respectively, as Secretary and Chairman of the Exec. Comm. of the Arkansas Water & Sewage Conference. They must be a couple of good Joes.

* * *

Do you recall the picture I ran in March, of Ralph E. Fuhrman, Federation Prexy, making a speech, and that I ask for a caption for the picture—and that Walter H. Cates of Los Angeles made a suggestion. Now comes a card from "Jo" (Mrs. Ralph E.) Fuhrman, who writes: "Dear George: Regarding the picture of Ralph, it occurred to me that he was taking full advantage of his opportunity—he doesn't get many such chances to open his mouth at home."

* * *

Had a note from "Bob" McCall, a VIP in the West Virginia Health Dept., as follows: "Dear Doc—I have finally awakened from the daze of finding myself in the Army again to also find myself without access to your excellent publication. Please put me on the subscription list again. In case West Virginia news has not reached you, Uncle Sam crooked his finger at me last fall and I am assigned as Sanitary Engineer, Headquarters Fifth Army, with installations in 13 states to cover. It hurts to be away from West by G— Virginia, but there's a real job to be done here, too. R. G. McC., Major, MSC."

Thanks for the plug and did you get your subscription, Bob?

* * *

Small World No. 13—I was reading the list of persons that Linn Enslow had photographed at the Purdue Industrial Waste Conference and I turned over the sheet of note paper. There scribbled on the back were these hieroglyphics—"Art Priebe, Rockford, Ill. Rediesel Supt. Sew. Treat., Research, etc."

There could be only one Art Priebe of Rockford, Ill. I asked Linn, and sure enough it was the super insurance salesman, himself; my college fraternity brother at the University of Illinois. Linn had sat down at an empty place in the dining room and fell to talking to the man on the other side of the table and when Art learned of Linn's interest in waste treatment he told about some work being done out his way, of which we'll have more later. Sorry I didn't see Art who was giving a lecture on Insurance. 'Tis indeed a small world.

* * *

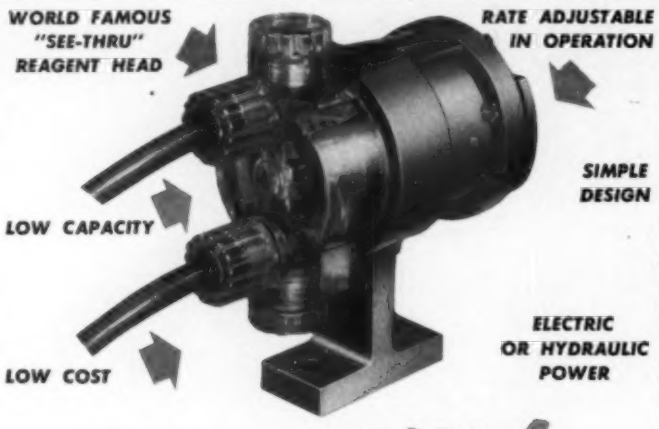
Down at the N.J. Sew. & Ind. Wastes Assn. meeting in Atlantic City, I picked up a few laughs. B. I. Corson, Instructor in Sewage Plant Operation at the Camden County Vocational School, was telling his experiences over the past 22 years. When he first began to teach, his students were mostly septic tank operators—"The Strong Back and Weak Nose Fraternity," Corson characterized them.

Corson also told about the attitude toward sewage treatment in those early days. One Mayor said flatly he wouldn't O.K. funds for a sewage plant laboratory, "Because all the operator would use it for would be to make hooch."

* * *

As I write this, "resting" in Lake Worth, Fla., getting ready for the big Miami show next week, I can gaze up at a beautiful azure sky with floating white islands, and palm fronds waving in the gentle breeze, but there's a disturbing note, too. Across the street is the steady put-put of a gasoline driven pump cleaning a septic tank. I just can't seem to get away from business, anywhere.

**V.T.Y.—Doc.**

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CHLOR-O-MITE

Here's important news for those who need a low cost, low capacity hypochlorinator . . . camps, homes, farms, auto courts, restaurants. The new Chlor-O-Mite now brings %Proportioneers% accuracy and dependability into a new low feeding range! It's powered either electrically or hydraulically — and feeding rate is *adjustable while the Chlor-O-Mite is in operation.* This feeder is complete in every detail, easy to hook up, ready to give maximum water safety without any additional accessories or controls. Write today for full information and price of the Chlor-O-Mite. %Proportioneers, Inc.%, 350 Harris Ave., Providence 1, R. I.

% PROPORTIONEERS, INC. %

# "TAKES THE BULL BY THE HORNS"

## BOOSTS SEWER MAINTENANCE 75% WITH NO INCREASE IN BUDGET!

**BULL STREET** runs through the heart of old Savannah. Many sewers that serve this section of town are nearly a hundred years old—and, considering the recent growth of the city, severely overloaded. Collections from low-lying areas, additions of storm and sanitary sewers, sand deposits, dense root growths and other debris greatly reduced the efficiency of already overtaxed lines. City officials saw need for action.

They carefully studied all types of sewer cleaning equipment and selected **"FLEXIBLE"** Power Bucket Machines, SeweRodeR, Steel Rod Sets and power drive tools. Previous experience with the city's original Power Bucket Machine assured them of safe operation on old sewers where joints are not too tight. "Flexible's" operating speed of 125 feet per minute in moving loaded buckets assured them of economy too and helped point the way to increasing the efficiency of sewer cleaning crews by 75%.

That's why city officials literally "took the Bull by the Horns" and bought enough equipment to begin one of the most thorough and extensive sewer cleaning operations of any city in the United States!

A freight car load of **"FLEXIBLE"** equipment is now in operation—and not one additional man was added to the payroll.

***A FULL CARLOAD OF "FLEXIBLE" SEWER CLEANING EQUIPMENT***

**AMERICA'S LARGEST MANUFACTURER OF PIPE CLEANING TOOLS AND EQUIPMENT...SEWER LINES...WATER LINES**

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## EXPANDING ROOT CUTTER AND SEWER CLEANER

Open and in action

removing roots and caked sediment like this.

It Fits in on Every Sewer Cleaning Job
SURE GRIP SEWER RODS
and ACCESSORIES

are joined together with a dual lock forming a rigid chain.

*Write for our new catalog on complete sewer cleaning equipment.*

**EXPANDING SEWER MACHINE COMPANY**
108 EAST WALNUT ST. HAPPANEE, IND.


(*Continued from page 82A*)

Sept. 19-21—Atlanta, Ga. *(Georgia Institute of Technology)*
GEORGIA WATER & SEWAGE ASSOCIATION. Sec'y, A. T. Storey, 1210 Hempkill Ave., N.W., Atlanta, Ga.

Sept. 19-21—Yankton, S. Dak. *(Charles Gurney Hotel)*
SOUTH DAKOTA SECTION A.W.W.A. Joint Meeting
SOUTH DAKOTA SEWAGE WORKS ASSOCIATION. Sec'y, Chas. E. Carl, State Board of Health, Pierre, S. Dak.

Sept. 19-21—Philadelphia, Pa. *(Stratford Hotel)*
PENNSYLVANIA SECTION A.W.W.A. Sec'y, L. S. Morgan, Dept. of Health, Greensburg, Pa.

Sept. 24-25—Denver, Colo. *(Cosmopolitan Hotel)*
ROCKY MOUNTAIN SECTION A.W.W.A. Sec'y, Geo. J. Turre, P.O. Box 600, Denver, Colo.

Sept. 26—
ROCKY MOUNTAIN SEWAGE WORKS ASSOCIATION. Sec'y, Carrol H. Coberly, 1441 Welton St., Denver, Colo.

Sept. 24-26—Biloxi, Miss. *(Buena Vista Hotel)*
ALABAMA-MISSISSIPPI SECTION A.W.W.A. Sec'y, Chas. W. White, 519 Dexter Ave., Montgomery, Ala.

Sept. 25-27—Milwaukee, Wis. *(Hotel Pfister)*
WISCONSIN SECTION A.W.W.A. Sec'y, Leon A. Smith, City Hall, Madison 3, Wis.

Sept. 26-28—Fargo, N.D. *(Gardner Hotel)*
NORTH DAKOTA WATER & SEWAGE WORKS CONFERENCE. Sec'y, Jerome H. Svore, State Dept. of Health, Bismarck, N.D.

Sept. 27-28—Saskatoon, Sask. *(Bessborough Hotel)*
WESTERN CANADA WATER & SEWAGE CONFERENCE. Sec'y, H. C. Lindsten, 301 Hamilton Bldg., Winnipeg, Can.

Sept. 27-28—Toledo, Ohio *(Commodore Perry Hotel)*
OHIO SECTION A.W.W.A. Sec'y, F. P. Fischer, 812 Perry Payne Bldg., Cleveland 13, Ohio.

Sept. 30-Oct. 2—St. Joseph, Mo. *(Robidoux Hotel)*
MISSOURI SECTION A.W.W.A. MISSOURI WATER & SEWAGE CONFERENCE. Sec'y, Warren A. Kramer, State Office Bldg., Jefferson City, Mo.

Oct. 8-11—St. Paul, Minn. *(Municipal Auditorium)*
FEDERATION OF SEWAGE & INDUSTRIAL WASTES ASSN'S. (Annual Convention) W. H. Wisely, 325 Illinois Building, Champaign, Ill.

THE SILENT WATCHMAN

## DIXIE TANK AND BRIDGE CO.

3523 LAMAR AVE. P. O. BOX 14
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*Complete Service for Elevated Water Tanks—*
*Nation Wide Service—30 Years Experience*

KEEP THE SAFETY FACTOR IN YOUR TANK THE DIXIE WAY

By welding seams, pits and rivets which gives a riveted tank 15% more Safety Factor than it had when built. No rivets removed, water supply maintained while work is in progress. On completely reconditioned jobs, the painting is guaranteed for five years, repairs guaranteed for ten years, provided the tank is painted every five years by Dixie Tank and Bridge Company. Yearly inspection, making all adjustments, if any, without additional cost.

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SOUND PRINCIPLES OF WATER TANK MAINTENANCE and TANK TALK, by W. A. RILEY

—SAFETY—SERVICE—SATISFACTION—

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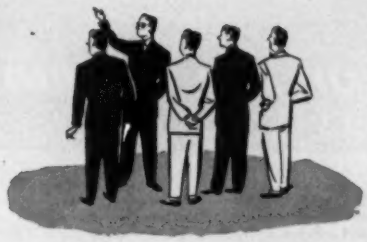
THE LARGEST ORGANIZATION OF ITS KIND GIVING SAFE MAINTENANCE AT LOW COST

# *Latest Facts about porous mediums...*

**FREE BULLETIN 1246** gives you the most comprehensive coverage of every factor concerned with the selection, installation and cleaning of Norton ALUNDUM* porous plates and tubes for activated sludge plants.



## *...FOR ACTIVATED SLUDGE SEWAGE TREATMENT*

Never before has so much vital information about porous mediums been packed in a 20-page bulletin. Here the 35 years' experience of Norton engineers and researchers has been boiled down into easy-to-read form.

### *How To Select*

Seven pages of charts and data cover every variable that enters into the job of choosing the right porous medium for your plant.

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Four pages of drawings, instructions and specifications make it easy for you to superintend correct installation.

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All the causes and cures of clogged plates and tubes are handled in fine detail in four fact-packed pages. Pro's and con's of the various cleaning methods are frankly laid on the table.

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## *POROUS MEDIUMS*

# The Spillway

*(Overflow From The Main Section)*

## Klassen New Chairman Ohio River Compact Commission

At the annual meeting of the Ohio River Valley Water Sanitation Commission (ORSANCO), Clarence W. Klassen, Chief Sanitary Engineer of Illinois was elected chairman, and E. Blackburn Moore of Virginia, vice-chairman. Mr. Klassen has been serving as vice-chairman of the Commission and chairman of the engineering committee; he is technical secretary of the Illinois Sanitary Water Board. Mr. Moore, speaker of the House of Delegates, Virginia General Assemby, is also chairman of that state's water control board.

Progress achieved in the year that has elapsed since the Ohio River Valley Water Sanitation Commission established "industry-action" committees was reviewed at a joint meeting of the Commission and industrial management representatives. The Commission also adopted bacterial-quality objectives for the Ohio River relating to water supply and recreational uses. This represents the culmination of almost a year's study by Harold W. Streeter, consultant to the Commission, and its engineering committee, on which sit the chief sanitary engineers of the 8-state agency.

Spokesmen for the metal-finishing, steel-producing, distillery and chemical-salt industry groups reported how they were compiling for themselves and the guidance of the Commission complete information on treatment methods, analytical procedures and relative costs of waste processing. Some of this material—developed under guidance of 12 subcommittees—will be published by the Commission for distribution to individual industrial plants.

Among those who reported on the work of their committees were: Dr. Frank Shipman, vice-president of Brown-Forman Distillers Corp.; Dr. Thomas Reed, chemical engineer, U.S. Steel Corporation; Walter L. Pinner, director of research, Houdaille-Hershey Corp.; and Walker Penfield, vice-president, Pennsylvania Salt Manufacturing Company.

The Commission also authorized studies directed toward establishment of treatment needs for various sections of the Ohio River. These studies are to form the basis for policy decisions by the Commission relating to discharges of phenol, chlorides and other wastes from industries and communities.

For large valves and frequently used valves, operating costs often are reduced and efficiency increased by remote control. In emergencies, quick operation of distant valves may be an extremely vital matter.

M & H Valves are furnished both for manual or remote control. M & H Hydraulic Valves have either Cast Iron Brass-Lined or Skeleton Type Brass cylinders, and are furnished with or without square bottom. Also electric motor operators can be adapted to M & H Valves.

M & H VALVE AND FITTINGS COMPANY
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FIRE HYDRANTS
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SHEAR GATES
CHECK VALVES
MUD VALVES
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FLOOR STANDS

COMPLETE INFORMATION ON REQUEST

M&H PRODUCTS Everywhere

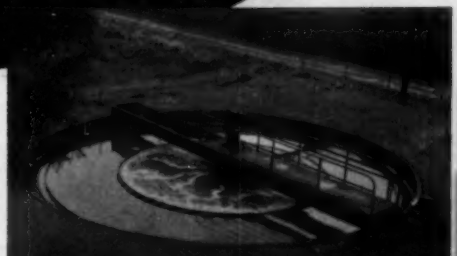
## Richard Hazen Opens Consulting Office

On May 10, Richard Hazen opened his own consulting office at 110 East 42nd St. in New York City. Mr. Hazen, who has been a partner in the firm of Malcolm Pirnie and Associates for the past five years will specialize in municipal and industrial water supplies and sewage and industrial waste treatment.

(*Continued on page 98A*)

# FOR *IMPROVED* CLARIFICATION AND *MODERN* TREATMENT of sewage and industrial wastes

*Performance proven!*



## PROCESS CLARIFIERS AND PROCESS OXIDATORS

As a result of numerous successful installations, more and more consulting engineers are specifying Process Clarifiers and Oxidators. Process Clarifiers are outstanding because of "know how" acquired from many years of experience in the design and operation of sedimentation units in various industries. Every installation of the Process Oxidator proves this revolutionary new sewage treatment process involving aeration, coagulation and sedimentation in one tank gives the results of intermediate treatment at practically the cost of primary treatment.

Send for Bulletin 106 or have one of our specialized engineers give you complete information without obligation. Write to any one of the addresses listed below.

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EASTERN AND MIDDLE WESTERN REPRESENTATIVE:
PACIFIC FLUSH-TANK COMPANY • 4241 RAVENSWOOD AVE., CHICAGO 13, ILL.

(*Continued from page 96A*)

"Dick" Hazen, the son of a famous father (the Hazen of the Hazen-Williams formula etc.) in sanitary engineering work, has made a name for himself in the years since he received a masters degree from Harvard after graduating also at Columbia and Dartmouth. Following his education Hazen was employed for two years by the West Virginia Pulp and Paper Co. before joining the Pirnie organization in 1937.

During the War "Dick" Hazen rose to the rank of Lt. Comdr. in the USN(R) in the Civil Engineer Corps of the Navy. Active in the AWWA, Hazen has just completed a year's service as Vice Chairman of the Water Resources Division and he is well known for his report as Chairman of a Special Committee on Water Works Law and he was chairman of the AWWA Filter Sand Specification Comm. He has recently been engaged principally on work in connection with the synthetic liquid fuel survey for the U. S. Army and with a sanitary engineering project in Liberia. His other experience includes the preparation of reports, and especially design work in both water and sewage.

THIS McWANE THREADED 2" AND 2¼" CAST IRON PIPE SCREWS TOGETHER

One man alone can easily screw together 18-foot sections above ground. One side of a joint is held by a long handle wrench which lays on the ground, while he screws another 18-foot section into the threaded bell. The 18-foot sections are made up at our foundry by screwing together two 9-foot lengths of McWane Threaded Pipe. For extra strength, the joint is oversize 2½-inch male-and-female threaded. Common practice is to screw the joint together alongside the trench or on skids laid over the trench, then "snake" the line into the trench.

For complete information write to McWANE CAST IRON PIPE COMPANY, BIRMINGHAM 2, ALABAMA.

McWANE
CAST-IRON
PIPE
*Lasts for centuries*


## 20th Arkansas Water and Sewage Conference*

The Twentieth Annual Arkansas Water and Sewage Conference under the chairmanship of Elmo A. Lambert was held in Hot Springs National Park, April 9, 10, 11. With one exception the attendance was the largest in the twenty year history, more than two hundred being present at the meetings and the conference dinner.

Five sessions were held on Management, Distribution and Metering, Water Source and Pumping, Sewage, and Water Purification. In addition to the opening session on Monday morning these were arranged by Jack H. Wilson, Chairman of the Program Committee. The group was enthusiastic and the papers practical and of real interest.

Dean H. Whiteside, Arkansas State Supervisor of Education was the speaker at the Monday luncheon, while Earnest Boyce, Vice President, Federation of Sewage and Industrial Wastes Assns. spoke on Tuesday. Membership in the Sewage Section of the Arkansas Conference is fifty-two for 1951, an increase of five over 1950. Arkansas was the first Federation association whose 1951 membership showed an increase over the previous year.

At the Conference Dinner the feature address was on *Life Behind the Iron Curtain* by James W. Moonan, now of Little Rock, formerly a foreign representative of the United States. On behalf of the Conference Gaston F. Bell presented sets of matched luggage to W. R. Spencer, Chairman of the Executive Committee, and to Harrison Hale, Secretary, in recognition of their continuous service in these positions during the twenty years of the Conference. Others at the Conference who were present at the first meeting held in Fayetteville in February 1931 and practically all the meetings since were L. A. Jackson, Chairman 1933, and W. A. Mayhan, Chairman 1943, both of Little Rock, Charles Barry, Guthrie, Oklahoma, and A. P. Jones, Houston, Texas. Honorary memberships were presented to Spencer and Hale by Chairman Lambert and to Ed F. Byerley, West Helena, Chairman, 1944, by Solon Sanderson, Marianna, Chairman, 1949.

Plans were completed for the award on rating by the Arkansas State Board of Health of Approved Water Supply signs to be placed on highways approaching a town or

*Submitted by Harrison Hale, Prof. of Chem., Univ. of Ark., Fayetteville, Ark.

city. The inspection trip covered the beautiful new plant of the Hot Springs Water System. This efficient 6 mgd. plant is under the direction of Barney Brown, Superintendent for more than thirty years, and Chairman of this Conference in 1942.

The following officers were chosen for the ensuing year:

Chairman, Cecil A. Brown, Pine Bluff

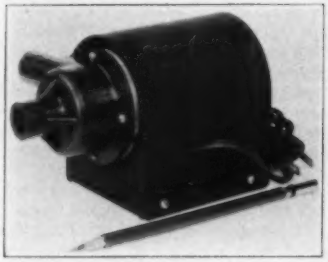
Vice Chairman, J. J. Highfill, Springdale

Secretary, Harrison Hale, Fayetteville

Chairman, Program Committee, Neal B. Thayer, Jonesboro

The 1952 meeting will be held in Fayetteville.

## Manufacturers' and Equipment News



### All-Rubber Centrifugal Pumps

601

The Gorman-Rupp Co., Mansfield, Ohio, has announced a new line of small centrifugal, all-rubber pumps, for handling both corrosive and non-corrosive liquids, and powered by tiny electric motors of from 1/200 to 1/35 hp.

Named the "Mansfield Line," the new pumps are of a size to be held on the flat of the hand, and weigh from 2 to 4 lbs. They are available as all-rubber or as rubber and bronze or zinc pumps. There are three types; enclosed and skeleton units, motor-driven, and belt-drive units. The overall capacity range is from 504 g.p.h. at 2 ft. head, to 78 g.p.h. at 10 ft. head. Both series are identical in power and dimensions,—Series No. 2 Models are provided with an air-handling device.

Design of these pumps is new and features a molded rubber volute, and a rubber impeller molded to a stainless steel shaft, which is mechanically con-


KENNEDY A.W.W.A. GATE VALVES

JOB-FITTED

...for a wide range of water works requirements

KENNEDY Fig. 56, A.W.W.A. Standard Double-Disc Gate Valve.

Every KENNEDY A.W.W.A. valve is JOB-FITTED...specially designed and engineered for the job it has to do. Conforming to A.W.W.A. standards in every detail, these Kennedy valves offer many extra-value features . . . one being the iron itself, which is 50% stronger than ordinary cast-iron . . . to keep them on the job year in and year out.

KENNEDY manufactures a most complete line of water works valves . . . in sizes from 2" to 60" . . . non-rising stem and outside-screw-and-yoke types . . . with a wide variety of gearing arrangements, controls, accessories and end connections available.

Standardize your community on KENNEDY valves . . . and fire hydrants . . . and you get dependable, trouble-free service that means greater economy and protection for decades ahead!

WRITE FOR BULLETIN 106

THE KENNEDY VALVE MFG. CO. • ELMIRA, N.Y.

Est. 1877

VALVES • PIPE FITTINGS • FIRE HYDRANTS

nected directly to the motor shaft. A diaphragm and seal combination of molded rubber completely covers the metal-supporting member, that joins the motor and pump structures. The stainless steel shaft is the only metal in contact with the liquid being pumped.

## Pennsalt Forms Industrial Chemicals Dept.

The Pennsylvania Salt Manufacturing Co., Philadelphia, Pa., has formed a new sales department, the Industrial Chemicals Department, combining the former Heavy Chemicals and Special Chemicals Departments, it was announced by William P. Drake, vice president.

The new department will be headed by Albert H. Clem, formerly assistant to the vice president in charge of sales. Previously to that assignment Mr. Clem was a field representative and then assistant sales manager of the former Special Chemicals Dept.

District sales managers appointed for the new department are: Philadelphia, J. M. Davidson; Paterson, N.J., C. M. McCloskey; Detroit, Macfarlan; Pittsburgh, W. P. Snelsire; Chicago, John C. Hampson; Cincinnati, Donald W. Graham, and Appleton, Wis., C. H. Anderson.

**Consider the upkeep, too!**

**Builders Visible Flow Chlorinizers** set a new standard for operating efficiency and low maintenance. These chlorine gas feeders are designed to save you money in the long run. Vital control and metering parts in Builders Chlorinizers handle nothing but dry, non-corrosive gas — a feature that's sure to conserve your upkeep dollars. Materials of construction (tantalum diaphragm, silver valve seat and needle, porcelain-enamel valve lining) are carefully selected to "stand up and take it", year after year.

Mechanical simplicity is a cost-saving feature, too. Your maintenance men can easily handle the operation and servicing of Builders Chlorinizers. For complete information and Bulletins on chlorinating equipment that's economical to buy and economical to run, address Builders-Providence, Inc. (Division of Builders Iron Foundry) 350 Harris Ave., Providence 1, R. I.

**BUILDERS PRODUCTS**

The Venturi Meter • Propelofio and Orifice Meters • Kennison Nozzles • Venturi Filter Controllers and Gauges • Conveyaflo Meters • Type M and Flo-Watch Instruments • Wheeler Filter Bottoms • Master Controllers • Chlorinizers — Chlorine Gas Feeders • Filter Operating Tables • Pneumatic Meters • Chronoflo Telemeters

BUILDERS-PROVIDENCE

## Tractor-Shovel On Crawlers

602

Frank G. Hough Co., Libertyville, Ill., has announced a new development in their track-type tractor shovels called the Model T12.

The basic and significant feature of this machine is the fact that it is a complete, integrated design of track-type tractor and shovel rather than a mere front end attachment for a conventional crawler tractor. Chief advantages claimed are that the engine is mounted at the rear to provide maximum balance and stability, the operator is located high and forward where he has fullest visibility and there is a special full-reversing transmission that provides 4 forward speeds and 4 corresponding but faster reverse speeds.

Bucket capacity is 1 cubic yard. Boom arms and bucket-dump are each controlled by a pair of double-acting hydraulic rams giving utmost utility, precise control and freedom from maintenance. The horsepower is 67 with either gasoline or diesel engine available.

## Golden-Anderson Elects Colton

Golden-Anderson Valve Specialty Co., Pittsburgh, Pa., has announced the election of Grant A. Colton as President. Mr. Colton was formerly Vice President and General Manager.

## Atlas Mineral Appoints Brock

**Former Mgr. Lancaster Sub. Water Co.**

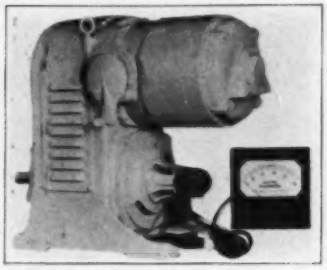
Atlas Mineral Products Co., Mertztown, Pa., has appointed B. Harrold Brock, formerly manager of the Lancaster Suburban Water Co., representative for "Mineralead" in central and western Pennsylvania and central and western New York State.



If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

George L. Wirtz, President, stated that Brock's appointment is in accord with the increased emphasis on Atlas service to water works engineers, in an attempt to inform such engineers of progress being made in the field of sulfur cements by Atlas Research Laboratories.

"Brocky's" many friends in A.W.W.A. and the Penna. Water Operator's Assn., will wish him well in his new work.



## Variable Speed Electric Tachometer

603

U. S. Electrical Motors, Inc., Los Angeles, Calif., has developed an electric tachometer arrangement for motor applications that require continuous and accurate speed indication. U. S. Varidrive motors are now available with this Model R-1 tachometer and generator in ratings from ¼ to 50 hp and speeds from 2 to 10,000 rpm.

The generator is coupled to the Varidrive and requires no other source of power. The tachometer indicator is entirely enclosed to prevent entrance of dust and other foreign particles, and can be mounted at distances up to 300 feet from the motors without affecting accuracy. Supplied with each unit is 10 feet of two-conductor cable, making possible the mounting of the tachometer in the most advantageous location.

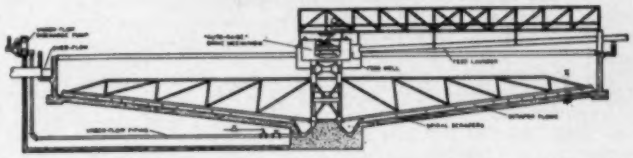
## Mathieson Chemical Builds New Plant

Blaw-Knox Co., Chemical Plants Division, Pittsburgh, Pa., has received a contract from Mathieson Alabama Chemical Corp. for the construction of a new chlorine and caustic soda plant to be erected at McIntosh, Alabama, on the Tombigbee River, north of Mobile.

The plant will use the Mathieson mercury cell process, which by the action of electricity, converts salt into high quality chlorine and caustic soda of rayon grade. The main raw material will come from the nearby McIntosh salt Dome.

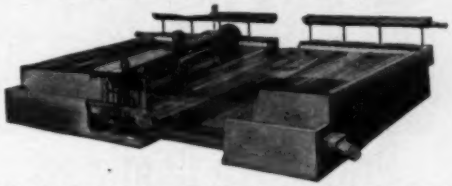

# *Hardinge* WASTE WATER *Equipment*

**CIRCULAR CLARIFIERS**



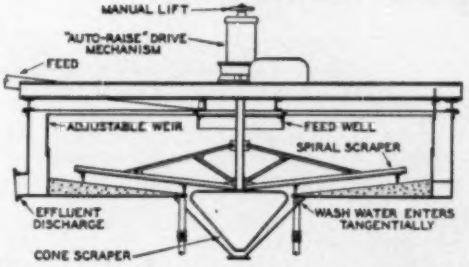
Hardinge Circular Clarifiers are available in sizes up to 200' diameter, either center-column or beam-supported for steel, concrete, wood or tile tanks. Bulletin 35-C-15.

**AUTOMATIC BACKWASH RAPID FILTER**



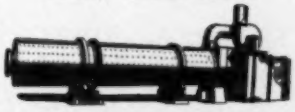
For high removal of non-settling or slow settling suspended matter. Self-cleaning sand bed. No shutdown necessary for backwashing. Bulletin 46-15.

**HYDRO-CLASSIFIERS**



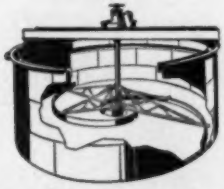

For rapid removal of coarse suspended solids from large quantities of waste water. Bulletin 39-H-15.

**ROTARY SLUDGE DRYERS**



Highly efficient rotary dryers in seven types. Model XH ideal for dehydration of garbage, sewage and sludge. Bulletin 16-D-15.

**THICKENERS**



**DIGESTERS**

Sludge scrapers and scumbreaker arms prevent scum accumulation, insure uniform gas production. Emit a dense digested sludge. Bulletin 38-C-15.

For removal of fine suspended solids from supply water, waste water and sewage. "Auto-Raise" mechanism prevents scraper breakage.

**RECTANGULAR CLARIFIERS**

Especially suited for limited spaces or where sludge delivery is desired at one end of the tank. Bulletin 35-C-15.

**HARDINGE**

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122 E. 42nd St. 24 California St. 205 W. Wacker Dr. 2016 First Ave. 200 Bay St.

## Carl Blom Elected V.P. of Byron Jackson

Byron Jackson Co., Los Angeles, Calif., has elected Carl Blom as vice president, according to an announcement by president E. S. Dulin.

Mr. Blom graduated from the Trondheim Institute of Technology, Trondheim, Norway in 1922, where he specialized in Hydraulic Engineering. After serving one year as an instructor in this Institute, he came to the U. S. A. and joined Byron Jackson as a pump design engineer. Advancing steadily, after joining the company he became Chief Engineer of the pump division in 1940.

Many important pumping projects include units that have been designed by Mr. Blom. Topping the list are the world's largest pumps for Grand Coulee Dam—six units, each to deliver 720,000 GPM at 300 feet when driven by its 65,000 hp electric motor.

## Front-End Truck Loader

604

Earnest Holmes Co., Chattanooga, Tenn., has developed the Holmes-Owen Self-Loader that converts a dump truck into a complete working unit.

Attached to the truck frame directly beneath the cab, the loader converts the truck into a unit capable of doing its own light digging, grading, loading, hauling and unloading. The shovel has a ½ yard capacity and the complete unit can be operated by one man.

When not in use, the loader arms and bucket rest back of the cab, out of the way. In this position, the loader equipment is completely out of the driver's vision and does not obstruct or interfere with the use of the truck for any other purpose.


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HOT APPLIED TAR BASE COATINGS
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J. H. Ballantine
*Chrm. of the Board*

D. E. Broggi
*President*

## Neptune Meter Elects Ballantine & Broggi

Neptune Meter Company, New York, N.Y., at a recent Board of Directors meeting elected John H. Ballantine Chairman and Dante E. Broggi President.

Mr. Ballantine has retired from the presidency after serving in that capacity for seventeen years.

Mr. Broggi was graduated from the College of the City of New York, Class of 1920. He joined the Neptune Meter Company in 1920 and has for the past four years served as Vice President and General Manager.

## Tierny to Manage New Worthington Plant

Worthington Pump and Machinery Corp., Harrison, N.J., has announced that Robert C. Tierney, formerly coordinator in the vertical turbine pump



If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

division, will be in charge of the corporation's new vertical turbine pump plant at Succasunna, New Jersey when it is completed. This was announced by L. C. Ricketts, vice president in charge of manufacturing.

After attending Newark Technical School, Tierney joined Worthington in 1935 at which time, he was engaged in general shop work. A year later he joined Worthington's engineering division at Harrison and in 1948 was made co-ordinator in the vertical pump division

## Pocket-Size pH Meter

605

Analytical Measurements Inc., Chatham, New Jersey, has developed a pocket-size pH meter and companion probe unit that permits instant, on-the-spot pH determinations anywhere.

Completely self-contained with batteries, in a bakelite case 3 x 5⅞ x 2½ inches, this instrument is furnished, camera fashion, in an ever-ready case with novel plastic tubes of buffer and KCl solutions. Total weight is 3 lbs.

Supports and beakers are completely eliminated by combining the calomel and glass electrodes with the sample holder, in a single polyethylene probe unit. This combination of sample holder with electrodes completely protects them and requires a sample volume of only 0.5 ml.

The meter is scaled from 2 to 12 pH, and a simple adjustment gives readings from 0 to 14. According to the manufacturer accuracy of 0.1 pH is obtainable. Hearing-aid type batteries, provide up to 1300 hours of operation. The electrometer tube, switch and input connector are sealed in a single unit to ensure freedom from high humidity difficulties. The one-knob control and continuous reading features of this instrument simplify operation for untrained personnel. Grounded samples can be directly measured because of no external power connections. The instruments and electrode are completely shielded.

# SIMPLEX TYPE H VENTURI METER

The Simplex Type H meter is designed specifically for use with Venturi Tubes, Flow Nozzles or Orifice Plates. It measures, with a high degree of accuracy, hot or cold water, process liquors or gases, under high or low pressure conditions. When used with appropriately designed Venturi Tubes, measurement of sewage or sludge may be accomplished with equal accuracy and ease.

This meter is built with maximum differentials of 114" or 64" of water to measure over ranges of 13 to 1 and 10 to 1 respectively. Standard design includes indicating, recording and totalizing features but, if desired, it may be furnished with various combinations of these elements.

Versatility of installation is attained through its various forms of mountings and its adaptability to different pressure conditions, particularly those of low pressure.

This instrument is one which may be recommended without hesitation whenever accuracy and long range of measurement are required.

*Write for Bulletin No. 401 to Simplex Valve & Meter Company, Dept. 6, 6743 Upland Street, Phila. 42, Pa.*

**SIMPLEX**

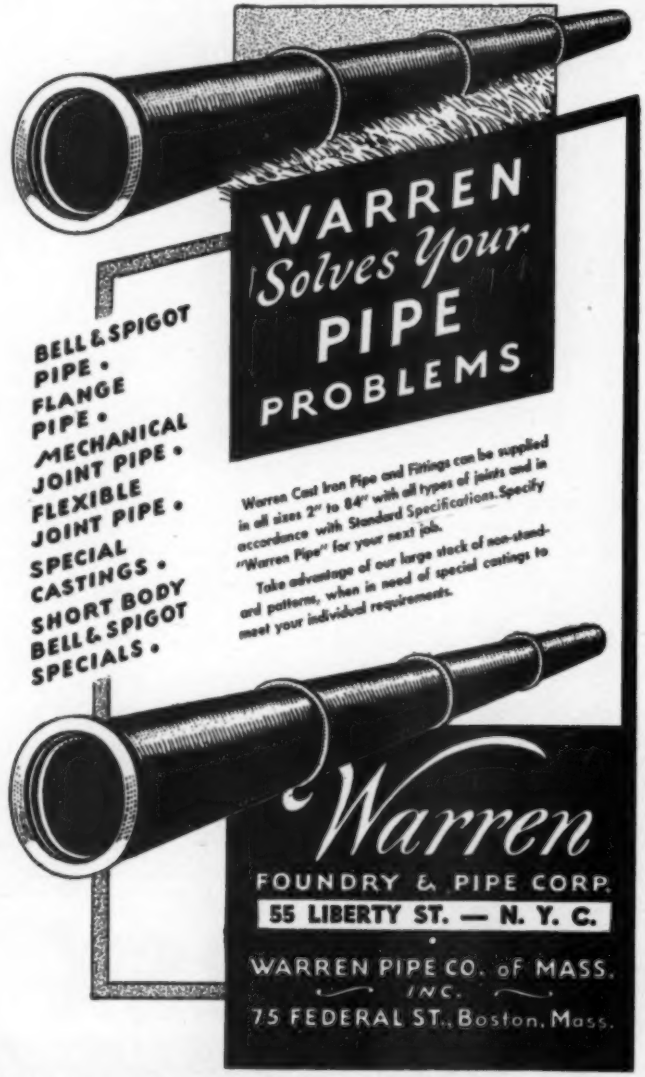
VALVE AND METER COMPANY

## Strickland Elected President of N.C.P.M.I.

National Clay Pipe Manufacturers, Inc., Cleveland, Ohio, has elected D. M. Strickland, who has been vice president since it was organized, president and general manager.

Mr. Strickland succeeds W. E. Robinson, president of The Robinson Clay Product Co., under whose regime as N.C.P.M.I. president the groundwork was laid for the association's present information and education program.

Mr. Strickland, who is a chemical engineer, has a long association with the vitrified clay pipe industry, having served with Southern Clay Pipe and N.C.P.M.I. for many years. Prior to entering the clay pipe industry, he was sales promotion manager for Armco Steel Corp. He is a graduate of Miami University, Oxford, Ohio.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BELL & SPIGOT PIPE • FLANGE PIPE • MECHANICAL JOINT PIPE • FLEXIBLE JOINT PIPE • SPECIAL CASTINGS • SHORT BODY BELL & SPIGOT SPECIALS •
Warren Cast Iron Pipe and Fittings can be supplied in all sizes 2" to 84" with all types of joints and in accordance with Standard Specifications. Specify "Warren Pipe" for your next job.
Take advantage of our large stock of non-standard patterns, when in need of special castings to meet your individual requirements.
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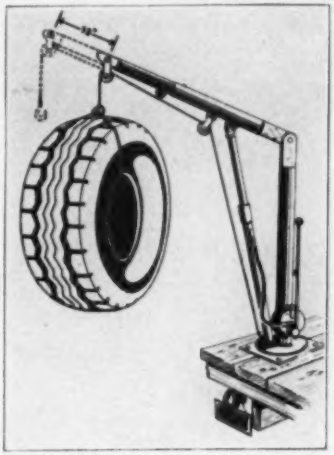


## Utility Hoist Extension

606

Unit Manufacturing Co., Minneapolis, Minn., has announced a 12 inch Boom Extension which will increase load travel of the Unit Utility Hoist from 77½ to 97½ inches. According to the company, the increase in load movement permits special handling operations such as setting pipe, working in man-holes, setting water hydrants, reaching over obstructions and the like.

A new Sheave Attachment—optional at extra cost—increases load travel an additional 25%. Lifting is done by a wire cable which is secured to a clevis attached to the lower end of the hydraulic cylinder and run through a sheave at the boom end.

The Unit Utility Hoist is fully hydraulic in operation, and its design permits quick transfer from truck bed to floor frame for shop use.

## A.C.F. Appoints Fluid Controls Co.

American Car and Foundry Co., Valve Division, New York, N.Y., has appointed Fluid Controls Co., Inc., of Philadelphia, as their representative in the sale and servicing of ACF Valves, for the entire state of Delaware, eastern Pennsylvania and in the Western part of New Jersey, according to John C. Coonley, manager of the valve division.

A subsidiary company, Fluid Controls, Inc., of New York already represents the ACF Valve division in the metropolitan New York area, and is an organization specializing in control problems and control valves.



**If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.**

## Root Destroyer

607

Hercules Chemical Co., New York, N.Y., has developed a root remover and root preventative, Hercules R-D, for use in sewers and sanitary drains.

The company states that Hercules R-D has been field-tested for 12 years and will destroy all root growths, with attendant fungus and slime, in sewers and sanitary drains, but does not harm trees or shrubs. A concentrated compound of crystals and fine powders, it is easily applied through the toilet bowl or directly into the sewer—straight from the container.

Hercules R-D does not contain lye, caustic soda or acids of any description, is absolutely safe to handle, easy to use and does not expose the user to the danger of burns, gases or any violent reactions.

## Atlas Mineral Assigns Oster & Lawson

Atlas Mineral Products Co., Mertztown, Pa., in an announcement by Mr. George L. Wirtz, President, stated that Mr. Ray Oster, Hollingsworth Building, 606 South Hill Street, Los Angeles, will handle the sale of corrosion resistant cements in the Los Angeles area and that Mr. Hugh G. Lawson, 417 South Hill Street, Los Angeles, will handle the sales of jointing materials for water and sewer pipe in the same area.

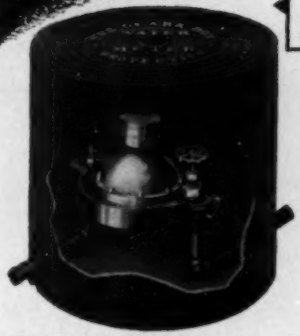
## Daylite Comparator Illuminator

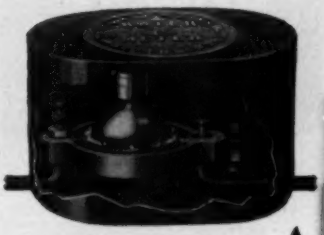
608

Hellige, Inc., Long Island City, N.Y., have introduced a Daylite Illuminator for their Pocket and Standard Comparators. The Illuminator provides the most suitable light for colorimetric work and insures reproducible results independent of time or


CLARK METER BOXES AND COVERS

Left, No. 16 Clark Wonder Lock Meter Box Round....16" and 18" diameters. Large 13" lid.





Above, No. 11 Oval Clark Wonder Lock Meter Box, especially for warmer climates. H-11", L-18", W-12".

Below, A-2-13 Clark Meter Box Cover with screw lock. Height 4", lid opening 13".

Above, A-2-11 Clark Single Lid Meter Box Cover, 4" throat. Also available in 6" and 9" throat.

Below, B-2-11-L Clark Double Lid Meter Box Cover, 6" throat. Also available in 4" and 9" throat.

Above, AA-3-12 Clark Meter Box Cover with 13" Wonder Lock Lid, for use with 15" (illustrated), 18" and 20" box body.

Improved Screw Lock with strong forged bronze bolt.

Wonder Lock Lid (bottom view) showing forged bronze bars.

Perfect Lock of one-piece manganese bronze forging.

write

H. W. CLARK CO.

MATTOON, ILLINOIS

# FREE

**to WATER WORKS and SEWAGE MEN**

## HOW TO CONTROL ALGAE

"The Use of Copper Sulphate in Control of Microscopic Organisms" by Dr. Frank E. Hale (former Director of Laboratories, Dept. of Water Supply, City of New York) is an authoritative work concerning the control of micro-organisms and elimination of tastes and odors. Describes in detail methods of controlling various forms of microscopic life commonly encountered in water supply systems. Contains descriptive material, plus 48 photo-micrograph studies of organisms discussed.

## ROOT AND FUNGUS CONTROL

"Copper Sulphate for Root and Fungus Control in Sanitary Sewers and Storm Drains," by John W. Hood, contains information published for the first time. This material includes actual methods for control and operating procedure. Here's the book that is a "must" for all sewage men.

**GET EITHER OR BOTH OF THESE BOOKLETS ABSOLUTELY FREE—**
These two valuable booklets, so important to all water works and sewage men, are yours *without obligation*. Mail coupon below!

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**40 Wall Street, New York 5, N. Y.**

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☐ "Control of Microscopic Organisms"
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WS-611


weather. With this accessory, Hellige Non-Fading Glass Color Standards of the daylight series can also be used in artificial light.

The Illuminator is equipped with a specially coated bulb and Corning Daylite Glass Filter and should not be confused with lamps using an ordinary bulb or blue glass plate. The ventilated metal housing measures 3¼ x 4¼ x 3¼ inches and has a sloping front to hold the comparator at an angle of 45° for increased ease of operation.

## De Laval Appoints Nilsen

De Laval Steam Turbine Company, Trenton, New Jersey, has appointed Mr. T. A. Nilsen as District Manager of a new Texas District Office recently opened in the Esperson Building, Houston.

Mr. A. N. Sarich, for several years the De Laval Southwest Technical Representative in Oklahoma and Texas will continue in the same capacity with headquarters in the new Houston Office.

## New Non-Seize Thread Compound

609

Armite Laboratories, Los Angeles, Calif., has developed a new metallic compound which combines the advantages of a lubricant and sealer to prevent the seizure of pipe, bolt, stud threads and gasket faces. According to the company, it is an anti-seize compound known as Led-Plate, with effective results when used in temperatures from minus 350° to plus 2900° F and even higher.

The metallic elements, of which over 70% is powdered lead, are held in suspension in hydrocarbons, and the materials will not dry out. No graphite is used and the compound can be used for steam, water, gas, air, oil, ammonia and various chemical connections.

## Graver Appoints New England Rep.

Graver Water Conditioning Co., New York, N.Y., has announced the appointment of Flagg, Brackett & Durgin, Inc., of 405 Park Square Bldg., Boston 16, Mass., as its New England representative.

This concern has specialized in engineering sales work on power plant equipment for approximately 30 years, and represents several prominent manufacturers of equipment for power plants, oil refineries, chemical process plants, etc.


# WHY BUY MARLOW PUMPS?

ONE IMPORTANT REASON IS—you eliminate many headaches when you standardize on one good line of pumps throughout your system.

Marlow makes the world's most complete line of plunger sludge pumps for sewage disposal works. In four sizes and two types. Any capacity required. There are more Marlow plunger sludge pumps in use than all other makes combined.

Marlow makes the world's most complete line of engine and electric motor driven self-priming centrifugal pumps. From small portables to units of 240,000 GPH capacity.

Marlow makes the world's most complete line of engine and electric motor driven diaphragm pumps. 2 and 3 inch lightweight, 3 and 4 inch single and 4 inch double, heavy duty.

Furthermore, Marlow has the largest pump distribution and service organization and Marlow distributors service what they sell.

For complete details see your Marlow distributor or write the factory.

**MARLOW PUMPS**

243 GREENWOOD AVENUE
RIDGEWOOD, NEW JERSEY

*The Standard of the Industry*




**If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.**

## Intrusion Alarm

510

Photoswitch, Inc., Cambridge, Mass., is offering the new Photoelectric Intrusion Alarm Set P1A to provide positive intrusion and burglary protection. The equipment provides a protecting wall of invisible light across any space up to 50 feet.

The alarm set consists of Photoelectric Control type A2OC-2 and Light Source Type L60B. An invisible infrared beam is projected from the light source and is aligned to strike the "eye" of the control. Momentary interruption of the beam actuates the control relay, which is wired to operate and sustain an external alarm device. Alarm can be silenced only by restoring the electrical circuit to original conditions by use of a manual or automatic reset switch.

## Worthington Breaks Ground for 20th Plant

Worthington Pump and Machinery Corp., Harrison, N.J., broke the ground at Succasunna, New Jersey, for a vertical turbine pump plant. Wielding the shovel was Mr. C. E. Wilson, vice president in charge of sales of vertical turbine pumps.

About 50 local residents, Worthington friends, and customers in New Jersey attended the gathering which was presided over by Mr. E. J. Schwanhausser, executive vice president.

The one-story building, measuring 80 x 200 feet, will be of the unit-type construction and will contain several bridge-type traveling cranes to be used primarily for warehousing and assembly work. Other features of the plant will include a 35,000 square foot macadam loading area on the north and west sides of the building and a siding that will be run from the nearby Lackawanna Railroad tracks along the east side of the building.

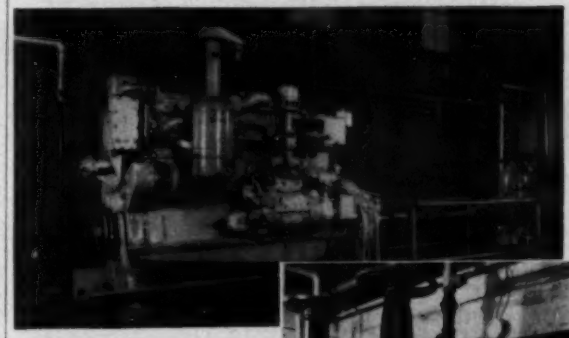
## Dual-Purpose Hand Truck

511

Clark-Hopkins Equipment Corp., Philadelphia, Pa., has introduced a new, dual-purpose hand truck with a built-in hydraulic hoist for lifting and stacking.


NEW CONSTANT FLOW

# Pump Control Safeguards Wells at Lower Cost



Pumping Station has Caterpillar D13000 Diesel engine driving 7 stage Worthington turbine pump. Whitman & Howard, consulting engineers.

Foxboro Recording Rotax Flow Controller electrically regulates throttle of Diesel engine to maintain constant rate of water flow.

At the Provincetown Pumping Station in Truro, Mass., a new fully automatic Foxboro pumping control system has solved a long-standing problem. Supplied by slow-flowing wells near the ocean, this station requires heavy pumping where over-drawing would permit seepage of brine into the wells.

Employing a Foxboro Rotax Flow Controller to operate a throttle control on the CATERPILLAR DIESEL pumping engine, this all-electric control system automatically maintains constant flow from the pump, without the attention of an operator. It affords important fuel savings because engine speed is automatically varied to compensate for pressure changes in the main.

For many inland pumping stations also, this new Foxboro Constant-Flow Pumping Control offers maximum safe withdrawal from slow-flowing wells, with complete protection against clogging the gravel pack with sand. Write for full details. **The Foxboro Company, 2286 Neponset Ave., Foxboro, Mass., U.S.A.**

FOXBORO Instrumentation

INDICATING · RECORDING · CONTROLLING

FACTORIES IN THE UNITED STATES, CANADA AND ENGLAND

*Since 1885*

**Patented Discharge Louver**

***of the GRUENDLER***

**Sewage Shredder**

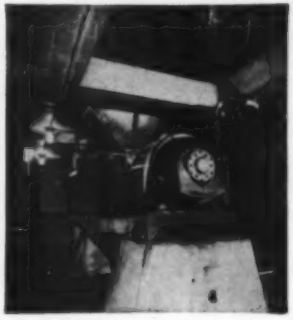
**Does It . . .**

Q. What is the Discharge Louver?

**A. The patented Louver is an ingenious Shredder-Grate Bar installed in the discharge of the unit.**

Q. What will it accomplish?

**A. Enables the shredder to disintegrate larger quantities or rag stock with ease along with normal run of sewage.**



**NOW sewage wastes, regardless of rag stock content, can be thoroughly disintegrated for even sewage flow. No clogging . . . less power . . . no costly maintenance.**

**BULLETIN SG-10 and names of Municipalities now operating with the Gruendler Sewage and Garbage Shredders, sent on request.**

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**CRUSHER and PULVERIZER CO.**

**2919 North Market**

**St. Louis 6, Mo.**

This combination hand truck and stacker is designed to fill the need for a small, light-weight, highly maneuverable, hand truck that will enable one man to load and stack heavy merchandise, after transporting from one location to another.

The Lift Stacker is of compact, sturdy construction and weighs 111 lbs. It has a capacity of 500 lbs. and will lift these loads to tail-gate height of 54 inches. The platform is 22 x 19 inches for accommodating larger size packages. The front of the platform is flush with the floor when lowered. It is equipped with 8 inch rubber wheels.

## Carlon Opens New Plant

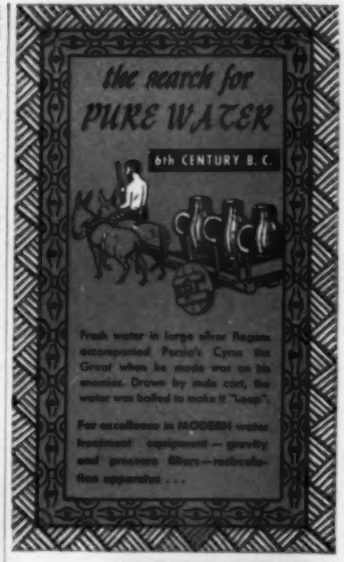
Carlon Corp., Cleveland, Ohio, has announced that a new Carolina Division has been established in Asheville, N.C. This new plant is part of a planned expansion program designed to place Carlon manufacturing facilities at strategic locations, the company said.

According to the company, the new Asheville plant will start its production with Carlon "TL" because of the great demand for this particular type of plastic pipe. The output from this new Carolina Division will be utilized to supply the Southeastern portion of the United States.

## Executive Elections at Johns-Manville

Johns-Manville Corporation, New York, N.Y., elected Leslie M. Cassidy Chairman of the Board and Chief Executive Officer, and Adrain R. Fisher was made President of the Corporation at a special meeting of the Board of Directors.

Mr. Cassidy succeeds to the post left vacant by the death of Lewis H. Brown who had been Chief Executive Officer of Johns-Manville Corp. since 1929, first as President and, from 1946, as Chairman of the Board. Mr. Fisher succeeds Mr. Cassidy, who became J-M's President upon retirement of R. W. Lea on January 31, 1951.




MECHANICAL EQUIPMENT BY ROBERTS FILTER MFG. CO. DARBY, PENNA.

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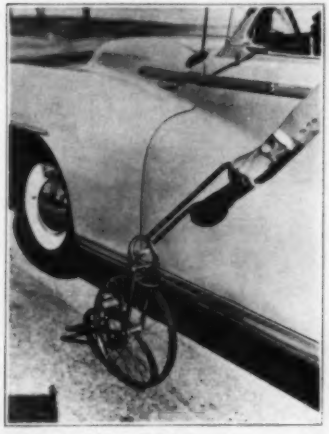
Clifford F. Rassweiler, Vice President for Research and Development, who was elected Vice Chairman of the Board and a Director on January 31, 1951, continues in those duties and in addition will continue to have full responsibility for organization and direction of the company's new Planning Board.

## Melnychuk Joins Omega

Omega Machine Co., Providence, R.I., has announced the appointment of Andrew A. Melnychuk as Project Engineer in the home office of the company.

Mr. Melnychuk holds a Master's Degree in Chemical Engineering, is a member of the American Institute of Chemical Engineers, and was president of the Junior Chemical Engineers Organization in New York City in 1947.



## Rolatape Measuring Wheels

612

Rolatape, Inc., Santa Monica, Calif., announces the Model 400 Rolatape, a measuring wheel which is exactly 4 feet in circumference and registers distances up to 100,000 feet, then repeats cycle. It accurately measures and records as it is wheeled over the course. The wheel does not sway in operation, but tends to stabilize its course and follow a straight line.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about pipe repairs
and replacements?

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LINED
steel
pipe

Now, more than ever, it's important that you get dependable, long term service from your equipment. "Downtime" is costly—replacements aren't always available. To assure yourself of uninterrupted production, install saran lined steel pipe now! In addition to the excellent corrosion resistance of this remarkable pipe—you have the plus values of rigidity, pressure strength and ease of installation, requiring NO special tools. These advantages are all important to you in the reduction of shutdown time and equipment replacement. For full information, mail coupon to The Saran Lined Pipe Company. *Saran lined steel pipe is manufactured by The Dow Chemical Company.*

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SP-91

SARAN LINED PIPE
DOW
product

The Model 400 weighs only 5 lbs., is easily and efficiently operated by one man and measures around corners, over contours with equal facility and accuracy. The counter is in plain view at all times immediately beneath the handle. The handle folds compactly so wheel can be easily carried and stored in car or trunk compartment. A handy stand holds wheel upright while operator is logging data, without losing count of distance. This model can be operated by the driver of a motor car, as he proceeds slowly over course to be measured, or by man on foot.

The company states that this model has been extensively field tested and is being used in water works applications such as physical inventories, leakage surveys, street opening surveys, locating paving cuts, main extension measurements, map correction, and general estimating work.

Besides the Model 400, Rolatape Inc., manufactures a Model 200 (2 feet in circumference) for shorter distances, and a Model 600 (6 feet in circumference) for longer distances and rougher terrain.

## Hooker Appoints Dauphine

Hooker Electrochemical Co., Niagara Falls, N.Y., in a statement by R. W. Hooker, vice president in charge of sales, has announced the appointment of Dr. Thonet C. Dauphine as manager of sales development of the company. Dr. Dauphine has been associated with the Oronite Chemical Company since 1946 as eastern manager of product development and prior to that was a supervising engineer for California Research Corp.

From 1936 to 1939, he was an instructor in the chemical engineering department of Massachusetts Institute of Technology from which he has two degrees, S.B. and Sc.D.

## F-M Opens Philadelphia Office

**With Robert W. Perry in Charge**

Fairbanks-Morse & Co. has announced the opening of a new branch office in Philadelphia, Pa., at 401 North Broad St. The manager of this office is Mr. Robert W. Perry whose association with Fairbanks-Morse began 26 years ago, when he started as a clerk. Throughout that time he has been salesman and Sales Department Manager. The new Phila. Branch Office will have jurisdiction over Eastern Pennsylvania, Southern New Jersey, Delaware and the Eastern Shore of Maryland.

## Psychoda Fly Control

613

Chemical Insecticide Corp., Brooklyn, N.Y., in conjunction with Mr. John Hood, Supt. of Sewage Disposal, Ridgewood, N.J., has developed "Chem-Larv," a product that is said to assure control of Psychoda Flies and provide residual control up to 6 weeks.

According to the company, Chem-Larv, is a new type of compound that, when added to liquid sewage, forms a true solution that actually penetrates into the zoogleal film killing the larvae and pupae in the film on the rocks. This is readily noted by examining the wetted rocks approximately 20 minutes after Chem-Larv has been applied, by which time many dead larvae will be evident. Approximately two to three days are required for suppression of adult populations.

(*Continued on page* 112A)

LEADITE
The Pioneer Self Caulking Material for C. I. Pipe
50 YEARS PROVE IT!

• Tested and used by engineers, water works men and contractors for more than 50 years. LEADITE has proved its dependability under most every condition of water main construction . . . proved that it makes a good tight lasting joint that improves with age.
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- *If you are interested in both subjects you get all the information in this one monthly magazine.*

(*Continued from page* 110A)

Chem-Larv is light in odor and requires no special handling equipment. It is easily applied to the dosing tanks. The manufacturer states that on a comparative basis, it is inexpensive and reduces application time as it usually requires only one-to-two man-hours of work to apply and a residual control up to six weeks may be obtained.

### Weinreich Becomes Supt. Worthington's Oil City Plant

Worthington Pump and Machinery Corp., Harrison, N.J., has announced that William F. Weinreich, formerly assistant superintendent of machine shops at the Buffalo plant, will be in charge of the corporation's newly acquired Oil City (Pa.) plant. He will be assistant to vice president Austin C. Ross, who is in administrative charge of the Oil City plant, in addition to being in charge of the Buffalo plant.

Weinreich came to this country in 1925 as a tool designer. In 1930 he joined Worthington's Buffalo plant as foreman of the tool room. Four years later he was put in charge of tool design and has been assistant superintendent of machine shops since 1941.

## Literature and Catalogs

### Household Sewage Disposal Systems

614

It is estimated that 17,000,000 persons are served by residential soil absorption systems in combination with septic tanks. Difficulties with such systems, and an investigation by governmental agencies, revealed a lack of any basic factual foundation for the design and maintenance of such systems. The U.S. Public Health Service, after making a thorough study of the problem, has come through with the initial 260 page illustrated report, which covers the findings of the investigating engineers. For a copy send $1.25 to the Supt. of Documents, U.S. Printing Office, Washington 25, D.C., asking for Catalog FS-2.56:1.

### Metering Pumps

615

P. E. Madden & Co., Chicago, Ill., has published an attractive, 2-color bulletin on **Madden Metering Pumps.** The bulletin states that Madden Metering Pumps are designed for the movement or transfer of fluids which cannot be successfully handled by ordinary pumps. These include, among the typical chemical uses, slurries of activated carbon, diatomaceous earth, filter aids, lime slurries, etc. Complete descriptions of the flexibility of operation, oil reservoir, drive shaft, diaphragm, operations, controls, valves and all parts are given along with photographs and cut-away line drawings.

A specification sheet and rating tables giving capacity, speed, horsepower, and pressure complete the bulletin.

### Chemical Lime Facts

616

The National Lime Association, Washington, D.C., has announced the publication of a new illustrated booklet on chemical lime, entitled **"Chemical Lime Facts."** This 42-page booklet on lime is divided into two main sections, as follows:

1. A fairly brief, yet complete discussion of the many diverse chemical lime uses, divided into the following categories: metallurgy, pulp and paper, chemicals, water

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treatment, sewage-trade waste treatment, ceramic products, building materials, protective coatings, feed and food by-products and miscellaneous uses.

2. A technical data section on the principal chemical and physical properties of lime, including such data as solubility, pH, strength of lime suspensions, specific vents, crystalline structure data, and neutralization values.

## Water Well Supplies

617

The National Supply Company, Pittsburgh, Pa., has announced the second edition of its composite **Water Well Supply Catalog.**

The company states that the new 128-page, loose-leaf book, first issued in 1949, is filling a need long felt in its field. It has been enlarged about 15 percent and now contains nearly 200 indexed types of supplies. These range from well Adaptors to Whipstocks and from bolts and nuts to complete water systems, all of which are fully described and illustrated.

## Prevention of Sewer Failures

618

Armco Drainage & Metal Products, Inc., Middletown, Ohio, has just published a new illustrated folder, **Help Prevent Sewer Failures Before They Happen,** that shows how Armco corrugated metal sewer structures can usually avoid such failures.

The folder describes how Armco Sewers can be used to meet practically all service conditions and have ample strength for long service. The folder further states that inspection reports on Armco structures used in storm, combined storm and sanitary, industrial, and sanitary sewers show, that despite 14 to 43 years of service, all were in good condition and had many years of useful life remaining.

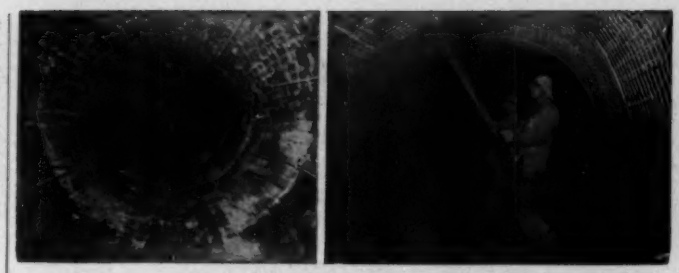
It also points out that Armco sewers are easy to install and offer a quick, easy and economical means of repairing failing sewers.

## Rubber Gaskets for Concrete Pipe

619

Universal Concrete Pipe Co., Columbus, Ohio, has just published **Specification 10,** a brochure containing the engineering specifications for the use of Hexseal rubber gaskets with reinforced sewer pipe.

Among the subjects covered by the text and drawings are: type of pipe, dimensions, pipe design, steel rein-

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**Erosion of mortar joints and dislodged bricks made many sections of the above 65-year-old brick sewer in Illinois both dangerous and inefficient. We placed a reinforced "GUNITE" lining of varying thickness in this sewer without opening the streets. Sewer service was maintained by installing temporary flumes and also by by-passing through relief sewers.**

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***We will be pleased to cooperate with you on any of your problems.***

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forcement, concrete, water curing, steam curing, curing compounds and curves. A special section in the brochure discusses installation instructions.

## Piping Fabrication and Erection

620

Dravo Corporation, Pittsburgh, Pa,. has made available a 24 page illustrated booklet entitled **"Piping Fabrication and Erection"** demonstrating its experience and facilities in this field.

Its many pictures show piping installations in steel mills, for gas transmission systems, central power stations, water pumping stations, heating plants, oil refineries and chemical process plants. Dravo's engineering and fabrication facilities are also illustrated and described.

## Chemical Feed Systems

621

Proportioneers, Inc., Providence, R.I., has made available a reprint from the proceedings of the Tenth Annual Water Conference of Engineers Society of Western Pennsylvania covering **Chemical Feed Systems.**

This 12 page reprint, amply illustrated with photographs and drawings, covers dry feed systems, and solution feed systems.

The illustrations show the different types of feeders such as: Disc, Oscillating, Rotary, Belt Gravimetric, Pot, Fluid, Piston Differential and Decanter Solution.

## Protective Lining for Concrete Pipe

622

American Pipe and Construction Co., Amercoat Division, South Gate, Calif., has released a folder on **T-Lock Amer-Plate.**

The folder describes the T-Lock Amer-Plate as a tough, long-lasting, acid-resistant lining for concrete pipe and structures, with a patented "T" which provides "locked-in" protection. The "plate" is produced from inert, synthetic resins, pigments and plasticizers compounded to make a sheet not less than .060 inches thick which is permanently flexible.

Amply illustrated with photographs, it shows how the plate is made, how concrete pipe is lined with the plate, and how it can also be used in structures. Results of exposure tests, complete physical data and an approximation table for amount of plate needed for different pipe diameters complete the folder.

## Steam Butterfly Valve Sizing Charts

623

Fischer & Porter Co., Hatboro, Penn., have just published a **Steam Valve Sizing Chart** covering the range from 1 to 1,000,000 lbs/hr. and a **Butterfly Valve Sizing Chart** covering the range of 15 to 10,000 gallons/min.

The charts, printed in two colors on index card stock gives complete procedure instructions and different sample problems.

## Laboratory Apparatus

624

Fisher Scientific Company, Pittsburgh, Penna., has just published a six-page folder illustrating and describing **Thirty-Seven New Developments From Fisher.**

The folder shows by means of text, photographs and drawings, scientific instruments, laboratory apparatus, and safety devices that have been developed and introduced during the past two years by the company. These items have all been

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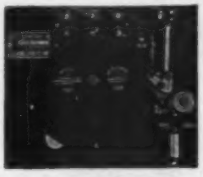

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*Type "A" Roto-Trol* operates from the pressure in the pump discharge line, at the pump house. The electric time delay prevents starting or stopping due to surges. It also protects deep well turbines from damage due to back-spin. . . . *Type "A" Multi-Pump Roto-Trol* is designed for two or more pumps discharging into the same discharge pipe. Adjusted time delays compensate for additional pumping friction and surges when second pump starts or stops.

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made available since the company published its most recent catalog supplement and the folder is designed to be incorporated in the catalog.

## Silica Removal by Deionization

625

Rohm & Haas Co., Philadelphia, Pa., has just issued a four-page, two color folder titled **Zero Hardness by Amberlite Deionization.**

The folder, emphasizing silica removal by Amberlite deionization was designed to assist the engineer generally to evaluate the usefulness, applications and recommended layout of ion exchange systems to provide water practically totally free from hardness, carbon dioxide and silica.

The text explains what results may be expected from the Monobed as well as multiple-bed systems; describes how deionization works; and suggests typical uses. A full page, illustrated with block diagrams, presents case histories with results attained in deionization by typical Amberiite Monobed, two-, three- and four-bed systems.

## Tunneling VS Excavating

626

Armco Drainage & Metal Products, Inc., Middletown, Ohio, has just published a new folder titled **"Why hire a wrecking crew to install underground structures"** that tells why it is no longer necessary to tear up pavements and disrupt business to install sewers and other underground structures.

The folder points out that lightweight Armco Liner Plates can be used simply and at low cost because of the ease with which they are installed, the minimum of excavation needed and their design which insures ample strength for a wide variety of uses.

Their physical properties are listed in a table and photographs show their use as water and utility line tunnels, relining for highway and railroad tunnels, and underpasses.

Other advantages claimed for Armco Liner Plate are reduction of maintenance, freedom from weather hindrance during construction and salvage and re-use when used for temporary tunnel lining.

## Corrosion Literature Abstracts

627

National Association of Corrosion Engineers, Houston, Texas, have announced that **Abstracts of Corrosion Literature** will be printed on McBee punch cards to reduce time needed to search literature for information. The 5 x 8 inch cards on which abstracts are printed have two rows of holes around their perimeter most of which have been allocated to the NACE Abstract Filing System with the necessary indices printed adjacent to the holes. Provisions are made for subscribers to add their own systems. McBee cards are sorted by pushing needles through designated holes, lifting the stacks and shaking out the desired cards.


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ONE OF DETROIT'S FINEST
800 ROOMS from $2.75
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HOTEL TULLER

The index system consists of eight main subjects: General, Testing; Factors and Theory; Environments, Preventive Measures, Materials of Construction, Equipment, and Industries. Within the main divisions are seven to 10 subdivisions, and within each subdivision, several subclassifications.

The subscription rate for 1951 will be $75.00. It is expected that the first set of cards will be mailed to subscribers about August 1, 1951, with subsequent mailings on a monthly schedule. Complete indexing information is included in the first mailing.

## Dorrco Hydro-Treator

628

Dorr Company, Stamford, Conn., has just published a new 32 page bulletin, in color entitled **"The Dorrco Hydro-Treator."**

This attractive bulletin describes the Hydro-Treator as a high-rate water treatment unit for the removal of hardness, turbidity, color and algae from municipal and industrial water supplies, that operates on the up-flow, or sludge blanket principle.

The bulletin contains photographs, drawings and complete descriptions of the various types of Hydro-Treators available, as well as specific information on operating results, capacity ratings and chemical dosing requirements.

Also included are a complete set of suggested specifications and four pages of tables and formulae commonly used by engineers engaged in the solution of water treatment problems.

## Hydrogen Zeolite Softeners

629

Cochrane Corporation, Philadelphia, Pa., have just issued a new publication on **Cochrane Hyrdogen Zeolite Softeners.** This is a 16-page bulletin giving a complete description of the process and the field of application, showing the advantage of Hydrogen Zeolite Softening and its relation to the Sodium Zeolite Softening process.

This informative bulletin gives an exhaustive explanation, not only of the process, but of the zeolites themselves and the details of the equipment used in the process.

## Plastic Pipe and Fittings

630

American Hard Rubber Co., New York, N.Y., has just released a new 16 page 2-color bulletin on **Ace-Saran and Ace-Parian** plastic tubing, pipe, valves and fittings.

Filled with complete engineering data, the bulletin states that these materials are, resistant to most chemicals, light-weight, tough, durable and have high impact strength. Of particular interest are tables of properties and tables of resistance to a long list of common chemicals.

The bulletin also gives bursting and working pressures, standard sizes and weights, etc., and offers helpful information on the fabrication of complete systems from these new plastics.

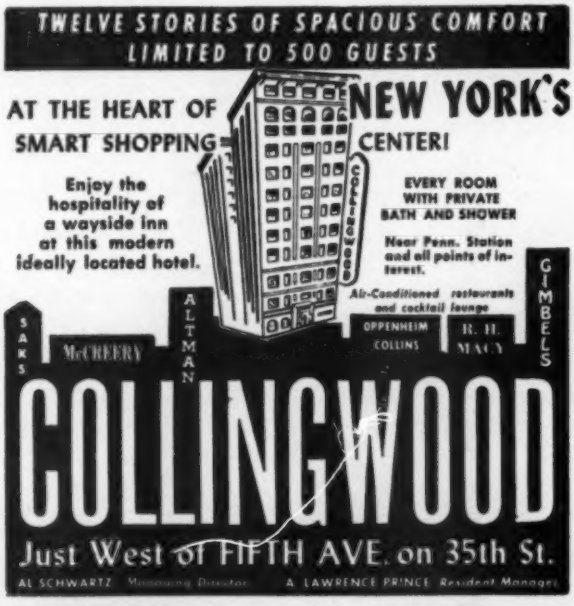
## Open Steel Flooring Specifications

631

Open Steel Flooring Institute, Inc., Pittsburgh, Pa., has made available a data sheet on **Standard Specifications for Open Steel Flooring (Grating).**

The specifications contained in the data sheet were prepared and adopted by the members of the Open Steel Flooring Institute, Inc., as a guide to prospective users of this type of flooring.

Complete details are given covering: type; workmanship; general requirements; material; engineer-



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ing; fasteners; stair treads; cutouts; banding; erection symbols and finish. A complete table of safe loads for standard open steel flooring is also included in the data sheet.

## Non-Return Valve

632

Golden-Anderson Valve Specialty Co., Pittsburgh, Pa., has made available a new 6-page bulletin fully describing the company's **Cushioned Single-Acting Non-Return Valve.**

Three different yoke assemblies on the elbow, angle and globe bodies are featured in detailed drawings, with a complete list of parts. The adaptability, testing, construction, installation, sequence of operation, servicing and specifications are fully described, along with tables showing general dimensions, approximate shipping weight, and general list of materials.

## Couplings and Long Sleeves

633

Dresser Manufacturing Division, Bradford, Penna., has recently issued a new 34 page catalog devoted almost exclusively to **Dresser Couplings.** The new book also covers the Dresser line of compression fittings and contains a spread illustrating the principal types of clamps, repair sleeves, expansion joints and other products produced by the company.

While being principally devoted to Style 38 couplings and Style 40 long sleeves for joining steel and cast iron pipe, the catalog also includes suggestions for joining small diameter pipe by simpler, time saving methods and many suggestions for repairing different types of pipe leaks and breaks.

## Power Operated Lubricated Plug Valves

634

Rockwell Manufacturing Co., Pittsburgh, Pa., has just issued a colorful new manual containing piping, wiring, mounting and installation data for **Power Operated Nordstrom Lubricated Plug Valves.**

This bulletin is the first complete compilation of technical data covering the use of pneumatic, hydraulic, and electric operators for lubricated plug valves.

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